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RIBBAND FISHES OF THE GENUS GYMNETRUS.

BY JONATHAN COUCH, F.L.S.

The habits of that family of Ribband or Band fishes called Gymnetrus are so little known that their history for the most part, is confined to the knowledge of the places where they have been taken, and the circumstances attending the capture. Yet there is reason to believe that they are widely distributed in the Ocean; for while the greater number of instances in which they have been obtained have been in the north of Europe, one at least is believed to have occurred in the East Indies, one in New Zealand, and another among the islands of Bermuda, of the particulars of which we intend to give a more minute account.

The earliest reference we have of a fish of this kind as being obtained in Britain, is quoted from the *Annual Register* by Albany Hancock, Esq. and Dr. Embleton, as having occurred about the year 1759; but it was not described by any scientific naturalist, and we might have entertained doubts concerning the species, and even the genus, but for the mention of a circumstance attending it which has since accompanied the capture of every example, and which, therefore, while it forms a character, permits a doubt to continue with regard to the exact form of some of its parts. It became easily broken and mutilated when handled, as was the case also with the next specimen of which we have any account. This was left dead by the tide near the little town of Newlyn, close to Penzance in Cornwall, in February 1788; the date of which is to be particularly noted, since there appear to have been repeated mistakes concerning it. The occurrence of this example, which was then believed to have been its earliest instance in Britain, excited considerable attention at the time; and of it I possess a coloured drawing, which was presented to me by Mr. Chirgwin, near whose house the fish was found, and who expressed his belief that it was the authentic original from which all the other figures that have been circulated were copied.

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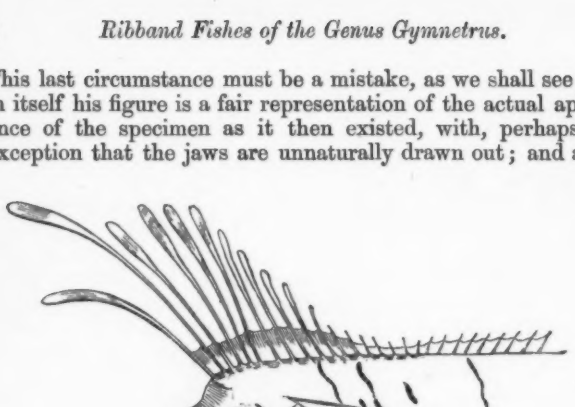
This last circumstance must be a mistake, as we shall see; but in itself his figure is a fair representation of the actual appearance of the specimen as it then existed, with, perhaps, the exception that the jaws are unnaturally drawn out; and at the



bottom of the drawing is the following inscription:—"This is a drawing of a fish that came on shore at Newlyn on Saturday the 23rd of February, 1788. Its length without the tail (which

it wanted) was 8½ feet, its extreme breadth 10½ inches, and its thickness but $2\frac{2}{4}$ inches.—M. Wright *fect.*" The artist has supplied the deficiency of a tail by something which bears a resemblance to the same part in the common sea-bream—but

without actually joining it to the body; and a deficiency also occurs at the head, where the crest or plume is represented by two long rays only that are bent forward, and each one tipped with a membranous expansion not much unlike the termination of a peacock's feather, but of a red colour, as are all the fins. The ventral fins are formed, each of a single ray, with its fan-like expansion, and reaching to about the middle of the body. The acknowledged imperfection of portions of this fish appears to have been deemed a sufficient warrant for the exercise of the imagination in persons who had not seen the original, but who undertook to form a likeness according to what they supposed it ought to be. Such must have been the case as regards a figure in the possession of the late William Rashleigh, Esq., F.R.S., etc., by whom I was permitted to take a copy of it; and which requires to be particularly noticed, as it was that from which Mr. Yarrell's figure was derived in the first and second edition of his *History of British Fishes*. In this case, the two rays which naturally rise from the forehead, and are so represented in Mr. Chirgwin's figure, are transferred to the throat, and thus the ventral fins are represented with double their usual number of rays, a mistake which is rectified in the last edition of Mr. Yarrell's work.

That Mr. Chirgwin, as above referred to, was in error when he supposed that no other drawing but his own was taken from the actual specimen at Newlyn appears from the fact that there exists in the library of the British Museum, bound up in a quarto copy of Pennant's work on the *Natural History England*, formerly in the possession of Sir Joseph Banks, a figure of this same fish, but which differs in several particulars from Mr. Chirgwin's drawing. In this the jaws are reduced to their proper position, but the rays on the top of the head are without their membranous expansion, and the ventral fins are broken short, which defects appear to be sufficient proofs that the figures in Pennant's volume were really copied from nature, but somewhat later than that of Mr. Chirgwin. The remarkable liability to injury in this fish, from rough handling, will explain the difference thus observed. Block's great work on fishes contains a likeness of what that author supposed to have been this Cornish fish, but his description of it appears to be scarcely intelligible. Some account of it, with a figure, was sent to him by Mr. John Hawkins, who had travelled on the Continent as a naturalist, but chiefly in pursuit of botany; but this gentleman appears to have sent also a small specimen of what both of them supposed to be the same species, but which had been taken in the East Indies, and what the Prussian naturalist is able to say on the subject is derived from a combination of these distinct and even diverse materials, with some confusion perhaps arising

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from not having well understood the information afforded by his Cornish friend. A claim has been made for two other examples of this fish as having also been taken in Cornwall—one in the year 1791, and the other in 1796; but after close inquiry I have found no ground for altering the belief that such was not the fact in either case; and in the last named instance it seems probable that the capture of Banks's oarfish at Filey Bay in Yorkshire, at that date, has led to the mistake; an opinion also countenanced by Dr. J. E. Gray of the British Museum, who communicated a satisfactory paper on this subject to the Zoological Society. As the published account of this last-named specimen gives a particular description of its appearance, we extract it more at large. It was thirteen feet and a half in length, rather more than a foot in depth, and not more than three inches in thickness. The skin was smooth and of a silver hue, it had no tail, and its fins were the colour of those of the roach or perch. The following notes are added from a private hand:—"The head seven inches long; eye, one inch and three-eighths in diameter; no scales, but very small protuberances, silvered over like the surface of a herring. These run the whole length in stripes, alternate with others that are bare and of a light colour. The dorsal fin runs the whole way from the head to the other end, and is red like that of a roach or perch: branchial rays six; dorsal fin with two hundred and ninety, and thirteen rays; pectoral fin with twelve, ventral one; no anal; no teeth, a soft tongue; the face and inside of the mouth black; anus, four feet nine inches from the head; iris a silver white."

Another example of this fish, which attracted much attention, was caught by some fishermen at Cullercoats in Yorkshire on the 26th of March, 1849, and fortunately came into the hands of Mr. Hancock and Dr. Embleton, who published a particular account of it in the *Annals and Magazine of Natural History* for July in that year. The fish was first seen at about six miles from land in water of the depth of from twenty to thirty fathoms. When first seen it was lying on its side on the surface, but as the fishermen approached it it became erect and came towards them with a gentle lateral undulating motion, with its crest and a small portion of its head above water. When struck with a staff it made off with a vigorous and vertical undulating motion, and quickly disappeared. In a short time it again came within reach, lying on its side, but when laid hold of with a hook it tore itself away, but was lifted into the boat at last by two young men placing their arms round it. It lived for some time after being taken on board, but there cannot be a doubt that when discovered it was in dying circumstances; and in every instance yet known it is clear

that these fish have been driven from their usual haunts by disease, these haunts being in some of the deeper and more secluded caverns of the ocean, beyond the reach of human sight. In shallower water, and with less protection from the rage of storm, their fragile structure would expose them perpetually to destruction; for in the present instance the rude handling of rough visitors was found to have injured it greatly, in addition to what it had undergone in its immediate capture.

The length of this fish was twelve feet three inches, the greatest depth eleven inches and a quarter; the body exceedingly compressed; in its general form resembling a double-edged sword-blade; four longitudinal flattened ridges, each rather more than an inch broad, extended from head to tail above the lateral line, the uppermost, which was the longest, running forward almost to the eye. The dorsal fin extended from immediately behind the upper and posterior end of the curved frontal profile to within three inches of the tail. The anterior part of this fin was more prominent than the rest, with twelve rays, which, when the fish was taken, are said to have been twelve or fourteen inches in length, and each furnished with a membranous expansion on its posterior edge, increasing in width upwards, something like a peacock's feather. The first ray was a rather strong spine arising within the frontal curve; the three next very slender, and much closer together than the rest; the next equally slender with the preceding, but rather further apart; the three or four after this nearly as strong as the first, while the rest diminished in strength and length, and became uniform with the more level rays of the dorsal fin. Exclusive of the crest, there were two hundred and sixty-eight rays in the dorsal fin. The fishermen said that this fin was without colour when caught, but it had a red tinge along the border when examined by the gentlemen who described it. Each ventral fin had a very strong spine, with a limited motion, and at first their colour was a bright red. It will be observed that the number of rays in the dorsal fin differed rather considerably from those which were counted in the example obtained in Filey Bay; but this variation offers no difficulty in regard to the sameness of the species, since it is generally found that where the fin-rays in fishes are very numerous, they are rarely alike in number in different individuals. It is only when they are few that their number affords a character to be depended on.

This fish, obtained at Cullercoats, of which we have given a very much abridged description, was conveyed to London for the purpose of being exhibited; and it was there that, in company with Mr. Yarrell, I was favoured with a private examination of it; by which opportunity I was enabled to

obtain the figure which accompanies this paper, and some notes which will enable us the better to understand some further particulars of its peculiarities. It is to be observed that the figure given in Sir John Richardson's (second) supplement to Mr. Yarrell's *History of British Fishes*, is represented, especially as regards the crest or plume on the top of the head, as it is said to have been seen at first by the fishermen, and not as when it was examined by the gentlemen who described it; but we prefer to represent it as it actually appeared when examined by ourselves in London.

On comparing the fish as exhibited with the figures represented in the great work on fishes by Cuvier, an adequate likeness did not show itself in any of them. The mouth appeared arched above, the mystache conspicuous, angle of the mouth depressed. The front ray of the fin on the forhead admitted of very little motion, but projected firmly forward; but this and all behind it were broken short, and no one of the fishermen who were present at this examination would affirm that the rays were at first bordered by a membrane through their whole length. A membrane united the rays for less than half their length, but beyond this it seemed uncertain. By joining the piece of the pectoral fin that had been broken off, this fin was shown to have the first rays longest, and consequently that it tapered towards the extremity. The tail portion of the body was remarkable, and therefore has required to be exhibited separately. The dorsal fin ended a very little short of it; and from thence the outline sloped downward, the lower portion forming an angle two or three inches behind a perpendicular line drawn from the upper. The exact internal structure of this part could scarcely be known without dissection; but from a fixed point of bone above there passed a firm bony curve, with the concavity towards the body, to the fixed point below; and from one to the other was stretched a thin substance resembling membrane, which appeared to represent something that might act as a fin, at least for the purpose of guiding or assisting its progress. A curiosity in the inward structure of this fish was observed in the convolution of the intestine, which passed backward close to the end of the body, and then returned to the vent that was much nearer to the head.

It is clear that this fish is an inhabitant of the northern seas, where it grows to a greater length than we have already mentioned; for since the date given above an example was obtained about five miles north of Wick, in Scotland, that measured more than sixteen feet. But there is much difference of opinion among naturalists as regards the distinction of species of several of the examples which have been met with. Dr. J. E. Gray has ex-

pressed his belief, "from a comparison of the various descriptions and figures given by English observers and those given by Ascanius, Brunnich, and Lindroth, that there is only a single species yet found in the North Sea, and that this species comes as far south as the coast of Cornwall;" while, on the other hand, Dr. Gunther, who is engaged in arranging the fishes preserved in the British Museum, expresses his opinion that five separate species have been found in the seas of Europe. Without attempting to decide where doctors differ so widely, I will add an account of a fish which may be of the same species, and certainly is of the same genus, which ran itself on shore on Hamilton Island, one of the Bermudan group, and of which, besides the notes published in the *Zoologist* for 1860, I was furnished with pen-and-ink sketches and measurements taken at the time by an officer of the royal navy. The contradictions which appear in the descriptions of this example by gentlemen who cannot be suspected of a wish to deceive, will afford a lesson how far we should implicitly accept the information conveyed by those who possess no knowledge in the science of natural history. This unfortunate fish encountered the usual fate of its race in suffering violence sufficient to destroy its symmetry, even at the first; the fears of its captors being excited by the belief that they had met with a sample of the far-famed serpent of the ocean, the existence of which has been so strenuously denied.

The effect may be imagined when we are informed that this supposed reptile was attacked with large forks, which were lying near at hand, for collecting sea-weed, by which it was "unfortunately much mauled" before it was secured. Its length was sixteen feet seven inches, and the general proportions much like those of Banks's oarfish, which the profile of the head also much resembles. The crest, or plume on the head is, in an American figure, given in *Harper's Weekly Paper*, represented as separate from the more level dorsal, but in others it is not so; and, says Captain Hawtaigne, in the *Zoologist*, this crest was formed of a series of eight long thin spines of a bright red colour, which followed each other at about the interval of an inch: the longest ray, which was in the middle, was two feet seven inches long, and flattened at the end like the blade of an oar. Mr. Jones, however, who more closely examined this fish, and better understood its nature, informs us that the number of rays in this crest was "ten or eleven, from two to three feet in extent." And my other account represents them as exactly ten, the longest three feet in length, and united by a membrane for more than half their length. In the American figure the dorsal fin runs to near the extremity of the body, of a bright scarlet colour, the pectoral much

injured, but with twelve rays. In all these descriptions there is nothing to lead us to suppose that this example was other than the usually described Banks's oarfish, except that Mr. Jones says that what remained of the right ventral fin was "composed of two consistent bony rays," which would be decisive of an hitherto unknown species, and even of an aberrant genus. A sketch referred to gives only a single ray to this fin, but in the American drawing there is the appearance of two. It is probable, however, that neither of these unscientific persons were aware of the interest attached to the question whether these rays were one or two, and until this is settled the exact nature of this fish must remain uncertain.

MOSS PARASITES,

BY THE REV. MILES JOSEPH BERKELEY, M.A., F.L.S.

Almost every one is acquainted with the rhymes which speak of the parasite upon parasite with which some members of the insect world are infested, and a similar legend would equally hold good with respect to other branches of the animal kingdom. Nor are vegetables less subject to become the prey of other vegetables. The mistletoe and broomrape, after they have done their worst by their victims, are in their turn infested with fungi, and the fungi themselves are obliged to submit to the attacks of other more minute species, though not exactly *ad infinitum*. Even lichens in their more arid form, subject as they are at times to months of drought and the direct rays of a burning sun, are not without their peculiar parasites, constituted to endure the same abrupt changes from continued damp to almost perfect dryness as themselves. Nor are the vascular cryptogams, such as ferns, mosses, and liverworts without their own especial enemies, though these are fewer in number perhaps than in other organized beings. Mosses, for example, besides affording a nidus for the development of such fungi as the pretty scarlet *Peziza axillaris*, which perhaps is only a false parasite, have one or two species which are developed in their substance, as *Septoria thecicola*, Berk. and Broome, and *Sphæria emperigonia*, Auerswald. The former of these was found on the ripe capsules of *Polytrichum piliferum* at Aberdeen, by Dr. Dickie, and the latter in Germany by Herr Auerswald, on the rose-like male inflorescence of *Polytrichum commune*, specimens of which are published by Rabenhorst in his German Fungi. Different as they are in structure, as will appear from the accompanying figures, there is good reason to believe that they

are merely different conditions of one and the same species, for nothing is more common than for fungi to exhibit two forms of fruit on the same or on different plants, after the fashion of

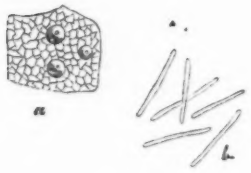

FIG. 1.—*Septoria thecicola*, Berk. and Broome.

a. Perithecia, magnified.
b. Spores, highly magnified.

FIG. 2.—*Sphæria emperigonia*, Auerswald.

a. Asci, magnified.
b. Spores, highly magnified.

monoicous or dioicous Phœnogams, a fact long since suspected by Fries, and now proved to demonstration by the brothers Tulasne.

Besides these pigmies of the vegetable kindom there are some higher Fungi peculiar to mosses, or indifferent as to their nutriment, whose spawn or mycelium runs over their leaves and quickly effects their destruction.

For example, nothing is more common than to find mossy sticks in our woods covered with delicate snow-white patches consisting of threads far more slender than those of a spider's web. These patches soon extend to the mosses, which presently become discoloured, and ultimately fade altogether. This enemy when fully developed is found to be *Corticium arachnoideum*, one of those fungi, which at a later period form little solid pellets which live through the winter, and are ready on returning spring to attack the tender shoots of another year's growth.

Another fungus still more destructive to mosses can scarcely have escaped the notice of those who are accustomed to greet Nature in all her phases. In calcareous districts, especially the Oolitic, where the stone fences are capped with a kind of mortar consisting almost entirely of comminuted oolite, which has been crushed down upon the roads, and adapted admirably for the development of many a moss, nothing is more common than to see the pretty tufts, which rejoice the artist's eye with their warm tints when lighted up by a sunbeam, more or less completely marred by large white mouldy patches, which soon run into decay. A close inspection shows that here again we have the mycelium of a fungus at work, though of a very different kind from that just mentioned. At first, indeed, nothing but the cotton-web is visible, but this soon becomes

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partially tinted with salmon colour, and then studded with little pale scarlet specks, which are the cysts or perithecia of a *Nectria*, which from its peculiar habit has been called *Nectria muscivora*. This species is found on the Continent as well as in this country, and appears in M. Desmazières *Cryptogames du Nord de la France* as *Sphæria bryophila*, having been found by him about the old fortifications of his neighbouring city, Lille.

FIG. 3.—*Nectria muscivora*, Berk. and Broome.

a. Perithecia, magnified.
b. Asci with sporidia, magnified.
c. Sporidia, highly magnified, natural size $\frac{1}{1000}$ inch long.

This little enemy is of the greater importance, and more worthy of being mentioned here, because it is no less active in destroying mosses under cultivation than in the open air. I have seen it at work in a little conservatory devoted to these beautiful and interesting vegetables; and it very soon proves fatal if the gardener is not careful to remove it with a feather or camel's-hair pencil, as fast as it appears.

I observed a few days since another moss parasite in a very peculiar position, which deserves record, as much on account of its curious habit, as because it forms an addition to our list of fungi which prey upon mosses.

The oolitic stepping stones which run along the ancient causeway leading from the site of Fotheringay Castle across the valley of Nene, produce, where they are not worn by the feet, a large quantity of that variety of *Orthotrichum cupulatum* which has a smooth veil, mixed with *Schistidium apocarpum*, and one or two other mosses. The capsules of the different species of *Orthotrichum*, as is well known, are just a year from their first growth in coming to perfection, and perhaps partly on account of their comparatively short fruit-stalk, and partly from the tenacity of the fruit-stalk itself, are more persistent than in most mosses, so that the plant at the present moment presents the capsules which were ripened last year, those that have just come to perfection and the rudiments of the crop which is to be matured early next summer. The teeth which surround the mouth of the capsule are sixteen in number, and when dry spread out more or less, but are not recurved as in several other species. I was surprised, however, to find in many of the old capsules, that the teeth were horizontal and applied by their edges to each other, exactly as when they were still within their lid, and just after the fashion of that arrangement of the unopened petals or sepals of phœnogams which is known by

the name of valvular æstivation. When immersed in water no change took place in their position, and the teeth seemed permanently glued together. This, of course, excited attention, and on opening one of the capsules it appeared that the mass of spores was infested by a little pink *Fusisporium*, whose slightly gelatinous spores had been the means of closing the orifice of the capsules, and preventing the dispersion of the spores. I did not indeed always find the mould within the capsule, its proper season being probably over, but on washing the surface of the united teeth, I was always able to obtain a quantity of the spores of the fungus, which from their peculiar form were not likely to be mistaken.

It is very possible that this little parasite may be extremely common, but I believe that it has not been observed before, and its discovery affords one among the many proofs that, even in the most unpromising situations, there is always some novelty to be found or some interesting fact to be ascertained if there is an eye to mark it.

FIG. 4.—*Fusisporium incarcerans*, Berk.
Spores, highly magnified.

The characters of the little parasite are not striking, and its specific distinction must rest partly on its peculiar habits, for the spores scarcely differ from those of one or two other species. Its characters such as they are may be given as follows:—

Fusisporium incarcerans, Berk. pallide roseum intra sporangium muscorum vel in peristomio nidulans, sporis arcuatis tenuibus triseptatis.

The spores are about 1-416th of an inch long, but, as is very often the case with fungi, are by no means uniform in size.

IS THE GIRAFFE PROVIDED WITH MORE THAN TWO HORNS?

BY T. SPENCER COBBOLD, M.D., F.L.S.

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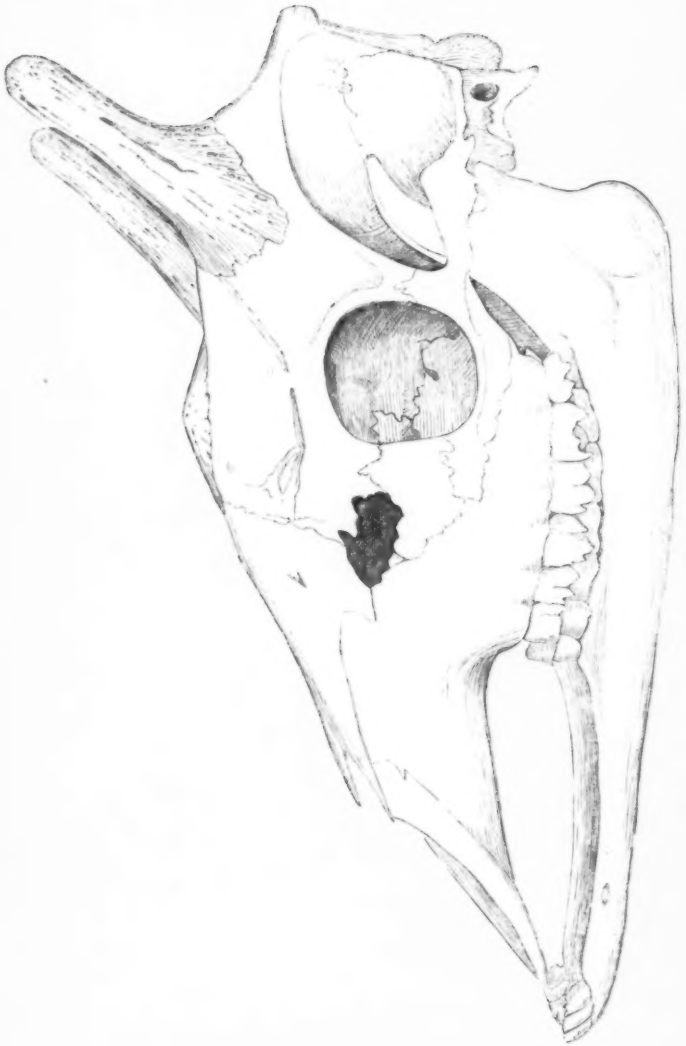
In the first of a course of public lectures "On the Structure, Habits, and Affinities of the Herbivorous Mammalia" which I had the honour of delivering at the Royal Institution of Great Britain, Albemarle Street, during the summer of 1860, I ventured to answer the above proposed question affirmatively. I say "ventured," because I was aware that in doing so I should be recording an opinion directly at variance with the published views of one to whose elaborate and long-continued researches the progress of anatomical and zoological science is deeply indebted. In the present case, however, we have to deal with a simple matter of fact, and I therefore proceed in the following pages to explain the grounds on which, in contradistinction to the statements of Professor Owen, it may be truthfully affirmed that there are three horns, or "pseudo-ceratophorous epiphyses," projecting from the skull of the adult male giraffe.

The veteran traveller, Dr. Edouard Rüppell, who, according to recent information, is still in the enjoyment of good health, and living in the city of Frankfort, was the first to declare unequivocally that a third horn existed in the full-grown male. In his trustworthy and admirable *Reise im Nordlichen Afrika*, published in the year 1828, he observes that "the horns constitute the principal generic character, they being formed by distinct bones united to the frontals and parietals by a very obvious suture, and exhibiting throughout the same structure as the other bones. In both sexes one of these abnormal bones is situated on each branch of the coronal suture, and the male possesses an additional one, placed more anteriorly, and occupying the middle of the frontal suture." Not having the original work by me at the present time, I quote the above translation from an excellent article in the *English Cyclopædia*, where a rough woodcut is also given, copied from Rüppell, representing the third horn in profile. In the *Atlas zu der Reise*, etc., the plates are beautifully executed, and from repeated examinations and comparisons, I am convinced of their accuracy in all respects. Though less developed and conspicuous, the mesial prominence is precisely like the two posterior epiphysial horns, and all of them are distinct from the true osseous elements of the cranium.

This early statement of Rüppell appears to have received the unqualified support of Baron Georges Cuvier, and so far



as I am aware, no anatomist found occasion to doubt its correctness before Professor Owen, who, from the examination of crania preserved in the Museum of the Royal College of Surgeons, Lincoln's Inn, was led to believe Rüppell's views to be erroneous. In his otherwise valuable memoir, modestly entitled "Notes on the Anatomy of the Nubian Giraffe," published in the second volume of the *Zoological Society's Transactions*, at page 217, he says: "In regard to the existence of horns in the two sexes, we find a few examples among both deer and antelopes, which thus resemble the giraffe. The horns of the giraffe possess, however, certain characters which are peculiar to themselves; the basis of the horn, for example, is articulated by synchondrosis to the frontal and parietal bones, and thus constitutes an epiphysis rather than an apophysis of the cranium. A broad, obtuse, osseous eminence in the middle of the forehead has been described as a third horn, and has been stated to be similarly articulated to the frontal bone, at least in the male Nubian giraffe, and to be the only instance of a horn developed in the mesial line of the cranium, and over a cranial suture in the mammiferous class." Cuvier says: "Au milieu du chanfrein est un tubercle ou une troisième corne plus large et beaucoup plus courte, mais également articulée par suture." J. B. Fischer describes the third articulated horn as peculiar to the male giraffe. To this sentence Professor Owen also appends a foot-note, wherein he observes: "The figure of the skull which illustrates the account of the Nubian giraffe in the *Atlas zu Rüppell's Reise im Nordlichen Afrika*, pl. ix. p. 23, represents indeed this third tubercle as distinct and articulated by suture with the cranium; but in the original cranium, from which the original figure is taken, and which I have examined in the Frankfort Museum, I could not perceive any evidence of the existence of such a suture; the mesial protuberance had not been detached from an epiphysial articular surface, but had been sawn off in order to be preserved in the stuffed animal." Further on, at p. 235, whilst instituting a comparison between the Cape and Nubian varieties of the giraffe, Professor Owen adds: "In the adult male Cape giraffe, the only appearance of the distinctness of the anterior protuberance is due to some irregular vascular grooves at the circumference of its base; but similar grooves are also visible in the skull of the female; and a section of the skull, taken through the middle of the frontal protuberance in the male, shows that it is formed by the thickening and elevation of the anterior extremities of the frontal, and the contiguous extremities of the nasal bones. In the male Nubian giraffes, which had attained nearly two-thirds of their full stature, the posterior horns, like other bony epiphyses, were less firmly attached to the skull than they were in the full

grown Cape giraffes, and they became detached from the frontal and parietal bones after a short maceration. Now if the anterior protuberance had been formed by a similar separate ossification, this would undoubtedly have been demonstrated in a similar manner; it, however, consisted only of a partial elevation of the frontal and nasal bones, as in the adult Cape giraffe."

The very argument which is here adduced by Professor Owen to prove the absence of the third horn, is precisely the one which I shall presently bring forward to show that the mesial epiphysis exists; but in the meantime I may observe that the Professor's convictions as to the certitude of his views are elsewhere more strongly expressed. Thus in his excellent article "Giraffe," in Mr. T. Brande's *Dictionary of Science, Literature, and Art*, at page 514, speaking of this animal, he observes: "Up to a very recent period, we find it described as having callosities on the knees and over the sternum like the camel, and as a kind of lusus with three horns, of which one, being articulated over a suture in the middle line of the forehead, seemed to take away from the chimerical nature of the unicorn by indicating a transition to that heraldic monster. The truth is, however, that the giraffe possesses neither those callosities nor this median articulated horn."

Having thus fairly stated the grounds on which the absence of a third horn is denied by our highest authority in vertebrate anatomy, I now proceed to record the evidence and experience which enable me to vindicate the originally received opinion, as expressed by Rüppell, and to throw light upon a question which should now, at once and for ever, be set at rest. In this persuasion, let it be observed, I do not stand absolutely alone; for, as I shall afterwards show, the independent *Osteologische Bemerkungen* of Dr. George Jaëger, as recorded by him in the twenty-sixth volume of the *Acta Acad. C. L. C. Nat. Cur.*, part i. section 3, for 1855, prove that distinguished anatomist to have been led to a similar conclusion:—

1. In the young giraffe which died last year at the Zoological Society's Gardens, Regent's Park, there was only a slight thickening of the subdermal periosteal tissues immediately above the central frontal eminence; but it was sufficiently thickened to allow of detachment by dissection; and I have preserved the separated portion in a dried state. This young male giraffe was only about six weeks old.

2. In another young male giraffe which died at the Zoological Society's Gardens on the 2nd of December, 1859, the fibrous sub-integumentary aponeurosis was still more markedly thickened; but there was as yet no development of a gristly cartilaginous tissue within its substance. This giraffe was born

on the 6th of July, 1859, and was therefore about five months old. I have given an account of the accidental circumstances which led to its death, together with the anatomical peculiarities it presented, in a paper entitled "Contributions to the Anatomy of the Giraffe," published in the *Zoological Society's Proceedings* for February 14th, 1860.

3. In an immature male giraffe which died at Edinburgh during the severe winter of 1854, I found the frontal aponeurotic thickening much more marked, forming on the dried skull a distinct fibrous mass, which presented an appearance in profile such as I have here represented in the accompanying diagram; the letters *a b* indicating the border of the fronto-nasal eminence, and *c* the fibrous mass. I subsequently detached this fibro-cartilaginous matrix for separate preservation and examination, but it was, I believe, swept away with other museum debris, by an assistant who had no knowledge of its value. After removal, it was perfectly transparent, and free from osseous deposit. The giraffe in question belonged to Wombwell's travelling menagerie, and was represented to me as being about eighteen months old. Having, at the outset, devoted three weeks to its dissection, and renewed my examinations of the various organs at subsequent intervals, I may, for further particulars respecting its anatomy, death, etc., refer to my several memoirs in the *Edinburgh Physiological Society's Reports* for 1854, the *Edinburgh New Philosophical Journal* for 1856, and more particularly to the June number of the *Annals of Natural History* for 1854.

4. When engaged during the autumn of 1856 in writing the article "Ruminantia" for the *Supplement* to Dr. Todd's *Cyclopædia of Anatomy and Physiology*, I took occasion to visit the Museum of Trinity College, Dublin, expressly with the view of examining the adult cranium of a fine male giraffe, which I understood to be preserved there. As a result of this inspection I subsequently wrote as follows:—"Through the kindness of Dr. Ball we have examined the skeleton of a male giraffe which died at the Dublin Zoological Society's Gardens, and which is now preserved in Dr. Harrison's anatomical museum. In this individual the central cranial eminence is not smooth as in our specimen (above referred to); on the contrary, it is particularly rough, owing to the deposition of osseous nodules which bear a marked resemblance to the irregular bony laminæ prolonged from the attenuated margins of the bases of the true horns. If these rough prominences could be shown to be separable by maceration, we might with good reason infer the

rudimentary existence of a third horn." This fine male formerly belonged to the London Zoological Society, and was bred in the Society's Gardens, Regent's Park. I have noted the peculiar cause of its death, in the paper already referred to, in the *Zoological Society's Proceedings* for 1860.

5. After completing the article above mentioned, I visited the museum of the Royal College of Surgeons, Lincoln's Inn; and having, through the ever-ready kindness of the late Professor Quekett, had an opportunity of inspecting the giraffine crania there preserved, I was in time to append a footnote to "Ruminantia" to this effect: "The osseous nodules noticed in the Dublin specimen not only exist in one of these crania, but they could be partly raised from the subjacent bone by the easy insertion of the finger-nail under the margin." Since the year 1856 I have repeatedly examined these crania, and have no shadow of doubt as to the existence of an ossified synchondrosis which has united the third horn to the frontal eminence.

6. The distinctness between the third horn and the frontal eminence was still more significant in the skull of an adult giraffe which died at the Zoological Society's Gardens several years back; but in this case also there was union by synchondrosial ossification. I examined the cranium in 1857, before the skeleton was finally cleaned and sent away, and have since been informed that it is preserved in a museum at Bristol.

7. The most cogent evidence, however, which I can adduce, is that derivable from the skull of a young male, whose cranium is here represented in profile, and whose entire skeleton may now be seen, set up and preserved, in the Derby Museum at Liverpool. This skeleton was formerly in the possession of Mr. Gerrard, the accomplished taxidermist at the British Museum, and I am indebted to his son for the loan of a carefully-executed drawing which I have here sketched in a reduced form, and caused to be copied in a tinted plate. In this instance, as I am distinctly and unequivocally informed by several gentleman connected with the British Museum, who have examined the skull, *the third horn became readily detached by maceration*, it was for a considerable time separately preserved, and presented all the ordinary characteristics of the two posterior horns, of whose epiphysial character no one entertains the slightest doubt. The third horn, or central pseudo-ceratophorous epiphysis, has since been glued on to its original position, and may now be seen *in situ*, as a standing proof of the correctness of Rüppell's original persuasion.

8. In the Museum of the University of Tübingen there is also preserved a similar skeleton of a young male giraffe, in which—according to verbal information kindly communicated to me by Dr. Gunther, of the British Museum, who is familiar

with the specimen—the third horn was equally well marked and separated by maceration.

9. Lastly, I adduce additional conclusive evidence from Dr. George Jaeger's *Bemerkungen uber die Hörner und Epiphysen*, etc., as recorded in the twenty-sixth volume of the *Acta* already referred to; and I beg to call particular attention to this extract, which I translate from a footnote appended to the memoir in question; the italics are mine. The author says: "In the skull of a young male in the collection at Munich, whose horns are scarcely two inches long, and likewise separated, there is, in the place of the third central horn, a rather strongly-marked elevation of the frontal bone, but no trace of an epiphysis. In the skull (nineteen inches long) of a male received a short time ago from the north of Africa, through Dr. Heuglin, which skull we believe to be mature, the suture of the hind horns is still perceptible, but the serrated borders are almost firmly united to the frontal and parietal bones. *The mesial horn, however, is still quite separated by the epiphysial cartilage from the frontal and nasal bones*, whose sutures are not yet obliterated, as also obtains in the other cranial bones. The anterior margin of the central horn-bone projects about one inch over the posterior limit of the nasal bone. From thence the anterior part of the horn rises to the tip, forming a very gradual slope, while the posterior inclination is comparatively steep and short. It results from this that the central horn unites with the bones much later than the hinder horns, which are common to both sexes."

After such evidence, it is scarcely reasonable to regard the point under consideration as still an open question. Had Professor Owen chanced to have examined the crania of younger males, he would undoubtedly have confirmed Rüppell and Cuvier in all essential particulars. The old skull at Frankfort, the skeleton at Dublin, and the cranium in the Hunterian collection, all seem at first sight to lend their support to his view, because the synchondrosial ossification has in all of these cases firmly welded the third horn to the subjacent fronto-nasal eminence; but even in some of these specimens a minute inspection indicates at the margins the original distinctness of the several osseous elements. The skull at Munich represents an example where the intervening fibro-cartilage has not yet commenced ossification, although it appears to be just on the point of doing so. The crania of young males preserved at Tübingen and Liverpool show the separable but distinctly-osseous third horn in a less completely developed condition; and the three young male giraffes dissected by myself severally displayed yet earlier stages, where the periosteal aponeurotic matrix in which the third horn would have been developed

had become more and more thickened, according to the relative increase of age. These being the facts of the case, I have no hesitation, for my own part, in asserting that every adult male giraffe is certainly possessed of three distinct horns, or, to speak in the more precise zoological phraseology which I have elsewhere adopted, this ruminating herbivore possesses three cranial "pseudo-ceratophorous epiphyses permanently invested by a hairy integument."

THE MINSTRELS OF THE SUMMER.

BY SHIRLEY HIBBERD.

It is one of the consolations of having to live within the hearing of the tolling of the hour by the clock of St. Paul's that all the summer minstrels are to be heard in the garden. Though only three miles distant, as the crow flies, from the General Post Office, Stoke Newington is annually visited by the nightingale, cuckoo, flycatcher, blackcap, garden warbler, whitethroat, grasshopper warbler, redstart, and some few other nomadic minstrels of less fame. Every spring it occurs to me that it would be an interesting contribution to natural history if we could have lists of all the birds visiting and nesting in the immediate vicinity of our great towns and cities, and as the plants peculiar to numerous suburban districts have been carefully registered, we might hope some day for similar catalogues of birds classified as to their localities, with especial reference to the nearness of their haunts to populous places. In the pages of *Rustic Adornments*, I called the attention of Londoners to the fact that at Stoke Newington the nightingale was always to be heard in its season, and in consequence of that intimation there have been numerous parties formed to visit the reservoirs in Lordship Road, where, in the secluded shrubberies, this and other warblers breed in perfect security. Though during the period of twenty years' experience in connection with the nightingale in this locality, buildings have increased to an extent which would be saddening were it not true that men are better than trees, the nightingales have not only not left it, but this year they literally abound, and since the 22nd of April I have commonly heard three and four at a time singing in rivalry among the trees surrounding my own garden. So with the cuckoo, its merry, inspiriting note may be heard resounding from every point of the compass, and wrens and blackcaps are almost as numerous as sparrows. This, I imagine, is to be attributed in some measure to our increasing

regard for the protection of small birds; people are beginning to appreciate birds as proper adjuncts of rural scenery, and the destructive propensities of the untaught are kept in check by proprietors who value birds in trees more than birds in cages.

The supposed ornithological poverty of suburban districts is mainly attributable to the infrequency of a habit of observation among the residents. People who believe that no more select feathered visitants than sparrows ever do them the honour of a call should adopt an agreeable method of putting the matter to the test. Choose a time between the 1st of May and the 20th of June, and to secure the best day let it be the 1st of June, and on that day renounce the solicitations of Morpheus. In other words, sit up all night, walk about the garden, read a play of Euripides in a room overlooking the woodiest prospect you have, and take care to keep the window open. I confess that I set apart many nights during that period to enjoy perfect stillness, broken only by the barking of dogs, the crowing of cocks, and the singing of feathered minstrels. With a cup of good coffee, and Virgil's *Georgics*, or a readable edition of Columella, better still the Psalms of David, it is like adding a year to one's life, so intense is the enjoyment of the coolness, the greenness, the music, and the whispers of the wind. From 8 till 11 P.M. the concert is kept up with unflagging vigour by thrushes, blackbirds, wrens, blackcaps, and nightingales, the cuckoo adds his bass accompaniment or chorus. I have just seen the sun rise after one of these nocturnal vigils, and I feel fresh: the dew is wet on my beard; I feel elastic, and should like to walk up a breezy hill, had I not noted a few passages in books that I have turned over, and to which I propose making reference. I have heard the muttering of crickets and beetles in the privet hedge, seen roosting thrushes change their places, heard a quarrel between two sparrows cowering under a ledge of timber on the roof of a shed, and counted the voices of nine species of birds between midnight and 2 A.M. Within one hour from 11.30 P.M. to 12.30 A.M. I heard the cuckoo, nightingale, thrush, woodlark, reed-wren, whitethroat, willow-wren. Soon after 1 A.M. I heard, in addition to the foregoing, the chaffinch, the wren, and the chiffchaff, and after two o'clock there was such a general mingling of voices that it was possible only to distinguish the thrush, cuckoo, chaffinch, and robin, whose utterances are so distinct as to be at all times unmistakeable. Far away on the borders of the New Forest, and among the crowded slopes of Herefordshire and Hertfordshire, I have at night heard the golden oriole, the ring-ousel, the water-ousel, and the grey wagtail; the last to be seen as well as heard during moonlight at the midnight

hour, but none of these, so far as I know, visit the gardens near London.

The music of birds has a different effect to music of every other kind, and it may be that the associations of vegetable luxuriance and the enjoyment of a refreshing out-door temperature assist the charm and are properly parts of it. Gassendi gives a curious reason for preferring the music of birds to that of instruments, and describes the effect of the latter on the mind—"Præhabebat porro vocibus humanis, instrumentisque harmonicis, musicam illam avium." Certainly with a western prospect, consisting of broken campaign sward terminating in a background of copse and tall elms, when the sun darts his first horizontal beams across it, and with a scarlet thorn to perfume the air and a thrush or nightingale in song overhead, the pleasure is as great as can be borne, and is enough to make one satisfied that our summer grows by successive increments, for if it were to burst upon us all at once it would be too much for ordinary powers of endurance.

It has been frequently remarked that song birds generally haunt the dwellings of man. This is particularly the case in Britain, though it is a mistake to allege that the birds of the tropical wilderness are deficient of musical powers, and in the tropics, especially of America, the richest bird-music is heard in districts where man is at most a sojourner, and has never chosen a site for a village or encampment. It may be that song birds like human society, as it is certain the robin, blackbird, and thrush do; and it may also happen that food and conveniences for building are more plentiful on the skirts of towns and villages than in deep forests and great open wastes. But this association has not been without its effect on literature; and when I have heard some of those wild Scottish and Irish airs that remain to us of the music of the past, I have often thought they were borrowed from the songs of birds; and I should suppose the modulations of the robin, the nightingale, and the song thrush, would furnish ready-made compositions, needing only to be copied, for the use of the mellowest human voices, and for any class of soft-toned wind instruments. Gardener's *Music of Nature* I have never seen, but have always understood that it is a reduction to musical scale of the songs of our best birds. Kircher, in his *Universal Harmony* (vol. i. chap. 14), attempted a reduction of the nightingale's song, and with much better success than Bechstein's reduction to words consisting of zi and zo endlessly repeated. The very thought of wedding such music to words, as I believe was done by the old Scottish and Irish minstrels, suggests the question, What do the birds themselves mean? for these exquisite utterances have a meaning, we may be sure, and are not far away from

parallels to the hymns and ballads we sing ourselves. Every observer of birds must be familiar with their several call-notes to each other, their expressions of joy and alarm, from the blackbird's "chuck" when in possession of a snail, and "chirrall, chirrall," when suddenly alarmed, to the harsh "chink" of the robin when about to fight. As Plato called flowers the joy of plants, we must perhaps be content with equal vagueness of description in designating song the joy of birds. When the heart is merry we are wont to sing, and while the woods and gardens resound with a thousand melodious lays we can discover therein a new cause for thankfulness to the Father of all things, not only that we are made happy thereby, but that all the world brims with joy and speaks aloud its ecstasy in the voices of these timid, fluttering creatures.

The language of animals is not a new theme. Sir William Jones tells of a lutanist who, in a grove at Schiraz, competed with the nightingales who gathered round him on the branches, and in their endeavours to outdo the musician fell on the ground at his feet exhausted. In the thirty-fifth number of the *Quarterly Review* is an account of a man who had learnt the language of birds, and knew by the call of the mother where the nest was, how old the young were, and how many she had reared in the nest. But this is nothing to the story of Porphyry, in his delightfully gossiping book on abstinence. He says, vindicating the possession of reason by animals, "that which is vocally expressed by the tongue is reason, in whatever manner it be expressed, whether in a barbarous, or a Grecian, or canine, or a bovine mode; all other animals that are vocal participate of it." * * * * "This, for instance, is related of Melampus and Tyanæus, and others of the like kind, that they understood the speech of animals. It is related of Apollonius Tyanæus that once, when he was with his associates, a swallow happening to be present, and twittering, he said that the swallow indicated to other birds that an ass laden with corn had fallen down before the city, and that in consequence of the fall to the ass the corn was spread about on the ground. An associate of mine informed me that he once had a boy for a servant who understood the meaning of all kinds of birds, and who said that all of them were prophetic." (*De Abstinentia ab esu animalium*, lib. iii. 3.)

Thales and Tiresias are both represented to have understood the language of birds; and Plato, in his picture of the golden age, supposes men to have understood the language of birds and beasts. Cicero says the Arabians cultivated this knowledge; and Sigard, in the Scadinavian Mythology, acquires the gift by eating the flesh of a serpent.

It is an old dispute, of which a book-lover never tires,

whether the song of the nightingale be merry or sad. As Hartley Coleridge puts it, it is a poet's question :—

> "Oh, nightingale, what doth she ail,
> And is she sad or jolly ?"

But the naturalist must have an opinion, and his decision will be that it depends very much on the mood of the person hearing it. Such exquisitely tender, plaintive, and refined modulations as the nightingale pours forth for hours together, and generally at a time when other birds are sparing of their songs, will, of necessity, induce a feeling of agreeable sadness. No intensely wrought performance in any department of art causes mirth; the absorption of enjoyment is fatal to jollity, which catches at things as they flit over the surface of life, and cannot go deep without the certainty of being lost. Homer and Horace give us no opinions on the subject. The passsge in the *Helena* of Euripides, beginning at line 1191 of Potter's version, is decisive as to the opinion of this careful observer of nature :—

> "Thee, sweetest bird, most musical
> Of all that warble their melodious song
> The charmed woods among,
> Thee, tearful Nightingale, I call.
> Oh come, and from thy dark plumed throat
> Swell sadly sweet thy melancholy note
> Attempered to my voice of woe."

The beautiful thought of Isaac Walton is familiar to every reader; not so, perhaps, that in Sylvester's *Du Bartas*, beginning—

> "All this is nothing to the nightingale!
> Breathing so sweetly from a breast so small
> So many tunes."

Sophocles invariably represents the nightingale as sad, and, in common with the poets, addresses the bird in the feminine gender. How awfully touching is that passage in the *Agamemnon* of Æschylus, where the chorus describes the "frenzy of a mind possessed with wildest ravings," as

> ——— "Like the sweet bird
> That darkling pours her never-ceasing plaint."

And what reader of Sophocles will forget the wandering Œdipus, in his blindness and exile, led by his daughter to a land the name of which they knew not, where

> ——— "In the midst
> Thick fluttering nightingales their sweet notes tune."

Whose line is that—"Dulces variat Philomela querelas?" It would be worth knowing, for it gives a new form to the discussion. Virgil comes near its spirit in the *Georgics* (IV. i. 511),

"Qualis populeâ mœrens Philomela sub umbrâ," etc.,* beautifully rendered by Dryden—

> ——— "Her children gone,
> The mother nightingale laments alone,
> Whose nest some prying churl had found, and thence,
> By stealth, convey'd th' unfeathered innocence,
> But she supplies the night with mournful strains;
> And melancholy music fills the plains."—(L. 741—7.)

Milton described the song as "most musical, most melancholy," yet, after all, these quotations go for nothing, except to show that, according to the mood of the mind is the nature of the impression, for the chorus in *Helena* is overwhelmed by anguish as the tragedy moves towards its climax. Virgil describes the song of a bird bereaved of its young, and Milton has it, in *Il Penseroso*, where every item of the furniture "some sad embroidery wears." So Æschylus, in the *Agamemnon*, makes amends for coupling the nightingale with images of woe—

> "Ah me! Ah me! the nightingale's sweet lot!
> A sweet existence that lamenteth not."

The nightingale is, in habit, one of the cheerfullest, as it is, perhaps, *the* most elegant of small birds. There is a tree in my garden on which a nightingale perches over my head a dozen times a day, while hunting for caterpillars and other dainties, and its sprightly action is unequalled for life and grace and spirit, coupled with a delicate shyness, most appropriate to such a marvellous songster. I often repeat to myself, as I enjoy the glorious concert, which, from the end of April to the end of June, rings out during the whole twenty-four hours, those lines of Gavin Douglas—

> "To bete thare amouris of thare nychtis bale
> The merle, the mavys, and the nychtingale,
> With mirry notis myrthfully furth brist."

It is at night only that the thought of sadness would occur, and as the nightingale, until his mate has hatched the brood, sings at all hours, except just before and just after noon, it only needs to be heard in the daytime to prove that, intrinsically, the song is neither sad nor playful; it is deeply joyous, rich, sonorous, and enlivening, except during the gloom of a moonless night, when it rises above the sigh of the fitful gust, and issues out of darkness like weird music from a tomb.

Birds vary much as to the power of individuals and the effect of circumstances. The same bird will trill out a more spirited lay after a warm shower than during a cold, dry east wind. There are times when, for a few hours, or a whole

* Comment peuvent se rencontrer ensemble la nuit et l'ombre du peuplier.—*Heutiana*, xlv.

day, the feathered choristers seem animated by a passion of emulation, and pour forth such an exuberance of wild music, that is almost more than a sensitive mind can bear. Such a day was Tuesday, the 29th of April, when the gardens of Stoke Newington seemed to be peopled with all the songsters of the world, engaged in an international contest. Others, beside myself, observed it; it was a subject of conversation for days after. Amongst the number then noticeable was a thrush, who had a nest hard by in a thicket, and who, since early in February, had made the welkin ring from the dawn of day till long after evening twilight. That same evening one of my neighbours—hating the noise, I suppose—fired a gun, and that particular thrush has not been heard since. Whether he killed the thrush I cannot say, he is perhaps happy that he silenced it. *Requiescat in pace*, with no ghost of a thrush to warble reproaches on his grave.

Cowper has the credit of first honouring in verse the frequency of the nightingale's song by day. But Rapin had already noticed the fact—

> "Omnes implevit ramos
> Noctes atque dies."—Hort. *lib.* ii.

And Shakspere has actually misrepresented the case—

> "The nightingale, if she would sing by day,
> When every goose is cackling, would be thought
> No better a musician than a swan."—*Merchant of Venice*, act 1, sc. v.

The song, day or night, is doubtless the most delicious music that ever saluted mortal ears since the day when the angels sang "Glory to God in the Highest." Milton was the first to make it the music of Eden, where Eve relates her dream to Adam, and when we hear it now, we may all say—

> "Music of Paradise! which still is heard
> When the heart listens."

Tennyson has caught at the same idea in *In Memoriam*, in the invocation to the nightingale—

> "Wild bird, whose warble liquid sweet,
> Rings Eden through the budded quicks."

Keats's ode is as rich and tender as the fullest gush of this rare warbler's notes, and it has the truth of all his rustic images and scenes, especially where he describes it—

> "In some melodious plot
> Of beechen green and shadows numberless;"

for strange to say, if there be a beech within range of the bird's haunts, he will choose that for his retreat, and at the present moment a pair have nested in a beech within sight of my study window. I would help to hang a bird-catcher, ama-

teur or professional, who would dare to molest them. I can only say more about the nightingale's song that the best description of it is in Conder's *Star in the East,* and that to account for its disappearance when its short season of love and song is over, Carew has a capital conceit—

> "Ask me no more, whither does haste
> The nightingale; when May is past.
> For in your sweet, dividing throat
> She winters, and keeps warm her note."

What a mystery is migration, and how much greater a mystery has it been made by that class of naturalists who persist in treating animals as if they were mere receptacles for food and vehicles of fur and feathers. The Marquis of Worcester's disquisition is worth reading for its quaintness, but the notions of Linnæus do discredit to that generally broad-minded philosopher, for the great master clung to the notion of swallows hybernating under the waters of ponds, and in Ellis's *Correspondence of Linnæus* are particulars of the experiments for any who would have a laugh at the great Swede. Stranger still that Gilbert White, most observant of observers, had a secret fancy for the hybernating theory, though well aware of the fact that the temperature of the blood of any of our summer birds is higher than that of man, or any other of the most active creatures. For a bird to hybernate, especially under water, is simply impossible. So energetic is the life of these little creatures that while they remain with us they scarcely sleep at all. You shall see swallows and swifts darting about till the last moment of twilight, and you shall see them again at half-past two next morning wheeling aloft and twittering as freshly as if they needed no rest, and so with the cuckoo and the warblers, the almost unbroken continuance of their song during the twenty-four hours round, is a proof of the energy of the circulation and all the vital processes. Their bones are hollow, they are themselves reservoirs of oxygen, and the flame of life burns more fiercely in their breasts than in any other class of animated creatures. Dr. Derham, in his *Physico-Philosophy,* notices two circumstances about migratory birds, first, that these *untaught, unthinking* creatures, should know the proper times for their passage, when to come and when to go; as also that some should come when others retire. Now to call them untaught and unthinking is to beg the question. In what revelation do we read that they are in either case such utter negatives? surely only in the revelation of human vanity. Experiments with which every tamer and *teacher* of birds is familiar, prove that their natural songs are acquired by the same process as we acquired a knowledge of A, B, C at school. As you pass along the side of a copse in July and August, you

will hear hundreds of little birds recording the songs they are just learning of their parents, and the parents always sing till their young have learnt their lesson properly; and hence, though the nightingale usually sings less vehemently after he has found a mate, he does sing till August if the first brood has met with an accident, and the parents hatch out a second. White records the singing of the nightingale on the 1st of May, and Markwick on the 4th of July, and the latter adds, "last seen, the 29th of August." Take a young bird from the nest before it is old enough to have learnt of its parents, and it will learn any song or no song, just as circumstances influence it. I have a canary that was brought up to the nightingale's song, and sings it to perfection. He has since learnt the chirp of the sparrow, the warble of the wren, the harsh twirking of the blue-headed parakeet, and the graceful melody of a creaking wheelbarrow. Hen birds of almost any kind will sing nearly as well as cocks if well trained from the nest, and if singing is so much a matter of tuition, why should not flying be. Anywhere just now you may see the sparrows teaching their young to fly, and a pretty sight it is; the prettiest of the season. If they are taught to fly from a tree to the ground, and from the ground to a paling, why not over seas and continents in such cases as render long flight necessary? We are met here with the word "INSTINCT," which gives no account of motives, of caution in avoiding accidents, or of the almost supernatural powers of sight and wing which migratory birds possess. The swift will fly a mile in a minute, and in the course of a season traverses eight times the circumference of the globe in search of flies within the range of less than an acre of territory.

I remember a match of pigeon-flying between London and Amsterdam, in which the winning bird flew at the rate of two miles every three minutes, according to the timing of the competitors, who started and received the bird at the two extremes of its journey. Let those who cling to the unsatisfactory solution of instinct keep carriers three years, and fly them on scientific principles, and they will, at the end of that period, toss Dr. Derham's idea of "untaught, unthinking creatures" to its proper limbo among obsolete notions. There are three things noticeable in the migration of birds; first, that change of residence is desirable; secondly, that they know where to go, and thirdly, they know how to go by the safest and the shortest route. Egypt houses a vast number of our summer visitants. Why we cannot say, except that doubtless the food and climate suit them. Africa, indeed, is the winter home of the greater number of the British warblers; and why they come here we cannot say, except that, as before, the food

and climate suit them. And what a blessing that our woods, and flowery leas, and gardens, are deemed worthy of a long stay, and of deep domestic joys by such happy, confident, and silver-throated creatures. The puzzle to naturalists is that they find their way over lakes, rivers, deserts, and seas, to the very spots that best suits them. I know a still more curious case, for when a boy I had given to me a pair of Guildhall pigeons, which I kept in a large cage of laths until they reared a pair of young ones. They then got out, owing to a rent in the laths, and made their way back to Guildhall, where, one of them having lost its tail, they were identified the same day by the friend who had scandalized the civic authorities in catching and sending them me. In this case the bump of locality must have been larger than that of philo-progenitiveness, and as the birds had never made that particular flight before, it was a greater puzzle than the passage of birds from Africa to England, or *vice versâ*, because these go in flocks, and there must be in every flock a certain number who have made the journey before, and can pilot the way for all the fledglings. Nor is it such a great undertaking, as it seems they rest on the rigging of ships, on headlands, and in places of seclusion, when stress of weather compels, and as the majority of migratory birds, especially those that traverse the Mediterranean, are insect eaters, they will probably find enough food to support them while on the wing, both by sea and land. The narrative by Mr. Thompson, in the *Annals of Natural History* for October, 1841, gives a list of twenty-seven birds which alighted or hovered about her Majesty's ship *Beacon*, during a voyage up the Mediterranean, in the month of April, and amongst them were the swallow, martin, willow-wren, quail, hoopoe, oriole, redstart, flycatcher, wheatear, and some of the minor raptores, When we see a sheep leave a parched herbage to rejoice in clover it does not surprise us, but we commend the creature for its good taste; the flight of a bird to a region adapted to its habits, when its hitherto home has ceased to be attractive, is but a similar process on a grander scale, and our wonder arises because of the distance, and the apparent frailty of the creature attempting it. But the poetry of the fact is heightened by granting reason and motive for the act, and wonder may stretch more wide her wings, and take flight with them through the mysterious darkness over pathless wilds, the more happy to be associated with roving intelligences that move according to a plan for mutual protection and guidance, than when resting in the thought that they know not how to go or where to go, but fly by blind destiny, the victims of erratic chance, like so many whiffs of gossamer scattered about by the winds. To see the swallows gathering at nightfall among the mists of autumn,

though a common enough sight to country people, is one never to be forgotten as long as a man lives. To talk of magnifying the Creator, by ascribing all those movements to "unerring instinct," is to reduce Almighty wisdom to the cunning of an artist who has made a toy, and is half frantic that it dances when he pulls the strings. How much more consistent with all the plans and operations of nature which He has ordered, to believe that these wanderers have had given them a sufficient intelligence to rule their lives for good, and direct their appetites and passions for the preservation and increase of each particular race. When Natural Theology squeezes the mind out of a poor bird, it stoops almost as low as the bird-catcher who has drawn his net upon a sparrow, and who then twists its neck, because, in the first place, he delights in cruelty, and in the second place it is not the bird he wants. Pretty creatures, putting human wits to shame by your long journeys, without chart or compass, from one flowery land to another, how many risks have you to encounter, like the first Phœnician merchants, or the voyagers for the Golden Fleece, yet how much wiser than they in your unerring course and peaceful purpose, to carry happy voices into every chosen haunt.

INSECTS INJURIOUS TO THE ELM.

BY H. NOEL HUMPHREYS.

It has been asserted that of late years our native elm has exhibited less vigour in its growth, and that, in many instances, trees which might have been considered in the vigour of their age have been seized with sudden symptoms of decay, and have rapidly perished. Some have attributed the less flourishing state of this handsome and useful forest tree to the extensive system of drainage now going on, as the elm prefers a damp soil. Others have suggested different causes; some, and apparently with most show of reason, assigning it to the ravages of certain insects which burrow between the bark and the hard wood of the trunk, which is the most probable cause.

Taking this as the most likely cause of a certain amount of decay, the experiments of M. Robert, an eminent French botanist, merit careful consideration. Some years ago the trees of the Parisian Boulevards having shown symptoms of disease, M. Robert, whose experiments in tree diseases were already well known, was consulted on the subject. He attributed their diseased state principally to the ravages of the larva of a small beetle—Scolytus destructor, and with a view to the prevention of

this cause, pared off portions of the bark in longitudinal strips, thus removing at once both the food and the protection of a great portion of the insect enemies. This measure was, however ineffectual, and M. Robert next proceeded to strip off the whole of the bark. This was considered by many a rash proceeding; but the event seems to prove that M. Robert was right, for entire colonies of insects were thus destroyed, and the bark, contrary to general expectation, is stated to have been perfectly reproduced. M. Robert, having apparently proved the efficacy of his method in cases where trees were attacked with scolytus, was called upon to apply his mode of cure to diseased trees in many parts of the French provinces, and also in Belgium; receiving various testimonial honours from many learned and scientific associations.

The severe method pursued by M. Robert may appear at a first glance extremely rash, especially on taking into consideration that the system of ringing only—that is, taking off a narrow strip of bark all round the trunk—is a method used for killing trees in forest clearings. Yet, we shall see, allowing his results to be indisputable, that M. Robert's process may be founded on sound botanical physiology. But let us first find the insect enemies of the elm, and having acquired a just idea of the exact nature of their ravages, consider whether the process of M. Robert be likely to prove efficacious for their destruction.

Among the most fatal of the tiny enemies of the elm, and others of our largest forest trees, is the Cossonus linearis, a terrible foe, for fresh specimens of which I am indebted to Mr. E. A. Smith of the British Museum. The figure at page 30 will convey a good idea of the insect in its perfect state. It is, however, in its larva state that its devastations are committed. The larva is, as may be conceived from the size of the perfect insect, very minute, and is a soft smooth grub totally devoid of legs, but it is furnished with considerable muscular power, and with powerful mandibles, with which it at the same time takes its food and perforates its miniature tunnel. This tiny creature does not only feed between the bark and the solid wood, either on the delicate liber or inner bark, or on the alburnum, that is to say, the last formed layer of wood, still in a soft state, but eats its way right into the heart of the tree through the sound, hard wood; and for these deeply internal ravages M. Robert's system offers no remedy. A colony of these creatures works upon the doomed tree, till it becomes perforated in all directions, and through every part of its vital tissues. The symptoms of disease soon show themselves; it loses the power to put forth its leaves; and, deprived of the result of their important functions, rapidly perishes.

Another enemy which, as being exceedingly numerous, is per-

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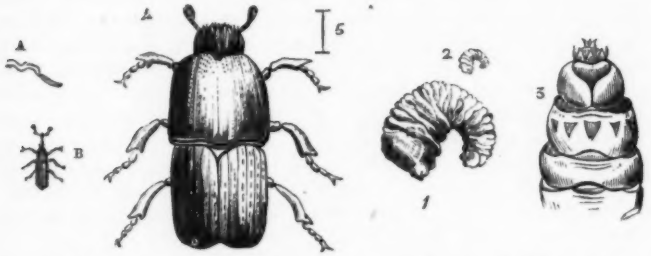
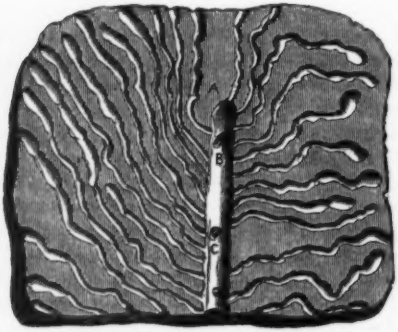
haps more fatal, is a small beetle known as Scolytus destructor, which is shown below. It is affirmed by some naturalists that this insect only appears upon a tree when a morbid or diseased



A. The tunnel of cossonus linearis.
B. Cossonus linearis.
1. Magnified larva of S. destructor.
2. Larva of S. destructor.
3. Greatly magnified head of S. destructor.
4. S. destructor magnified.
5. Size of S. destructor.

growth has already taken place; but I have found small numbers under the bark of apparently healthy trees. The first ravages probably induce that morbid growth which renders the multiplication of the insect more rapid, as softening the wood and bark, and rendering them more available as food. Scolytus destructor is one of a group of insects which the German naturalist, Ratzeburg, has minutely described in his *Forst Insecten* (forest insects), a great work which he produced at the request, and under the immediate patronage, of the Prussian government. He has figured in that volume many species of this genus and several allied genera, besides an immense number of other insects injurious to forest trees, exhibiting them, in many instances, in the larva, pupa, and perfect states, in order that foresters may recognize their enemies in all their stages.



No. 1.—Tracks of Scolyti on the wood of the elm.

The two engraved specimens of wood injured by the Scolytus and its congeners, will show the manner in which they eat their

way between the bark and the main trunk. Their food being the *alburnam*, or soft white portions of newly formed wood, as before stated, which lies between the *liber* or inner bark, and the already hardened wood or *duramen*. The insect leaves about an equally deep track in both bark and wood; though, in general, if a piece of bark be broken off, the larva of the Scolytus will come away with it. The specimen of wood, No. 1, page 30, shows the tracks of a colony of Scolyti. The perfect insect or beetle has the power of perforating the bark, say at A; it then commences a tunnel, till at B it forms a deeper cavity, which some describe as a turning place to enable the female to effect her retreat, should she survive the act of depositing her ova. I have, however, found eggs deposited in such cavities which appear to succeed each at certain distances, and in which, as it appears to me, successive batches of eggs are placed. When the eggs are hatched the young larvæ depart to the right and left of this main channel, eating their way as they go. It will be seen that at their commencement these lateral channels are very narrow, the larvæ being still small; but, growing as they advance, the channel gradually widens, till at last it terminates, at its greatest degree of breadth, in a blunt *cul-de-sac*. In this extremity of the channel, the larva having attained its full growth, sinks into the dormant period of its existence, in which it undergoes its change to the perfect or winged state. This takes place with only the protection of a slight husk, which it constructs for itself, very inferior in structure to the elegantly formed case of the chrysalids of butterflies and moths. The larva gradually shortens and thickens, and the wings, legs, antennæ, and other members belonging to the perfect state gradually develop themselves within this imperfect pupa case. The beetle, when the full metamorphosis has taken place, eats, or rather bores it way through the bark, and emerges from the dark chambers in which the earlier stages of its existence have taken place, to the open daylight. Its daylight

No. 2.—A piece of elm wood showing the tracks of B. Chalcographus and B. Topographus.

existence, however, is a very short one, and the female, so soon as her instinct teaches her that the time has arrived for depositing her eggs, bores again through the thick bark for that purpose, voluntarily quitting the daylight for ever, as she frequently dies almost immediately after depositing her last batch of eggs in the dark tunnel, which thus serves at the same time for the tomb of the parent and the cradle of the progeny.*

The curiously branching tracks of insects of this class have in many cases suggested the name by which different species are distinguished—each having a peculiar method of progression, which, of course, leaves a track of corresponding character. For instance, the insect of the genus Bostrichus, the larvæ of which makes the little branching channels which look like lines engraved on metal, and are marked A in the engraving of injured wood, No. 2, has received the specific name of chalcographus, from a term founded on Greek words meaning "an engraver on brass." Another, the one whose larva makes the

* I have just received the following additional details respecting the habits of the Scolytus, and the fatal nature of its ravages. These interesting particulars are from a paper recently read before the Entomological Society, by one of the most careful and accurate observers among our English entomologists:—"When the first warmth of spring sets in the perfect insect makes its escape from beneath the bark, by eating its way out; the female soon after selects a tree for the purpose of depositing her ova; she commences her perforation always beneath a little projecting piece of bark, at the upper end of a crack; she bores onwards and upwards until on the surface of the alburnum, when she ascends direct. The tube thus formed is from two to three and a half inches in length, three-fourths of a line in diameter, and of equal size throughout, except at a short distance from its entrance, where a small cavity is usually found, sufficiently large to allow the perfect insect to turn; on each side, in small crenules, she deposits her eggs as she advances. If the female insect live to effect her retreat, she closes the aperture by which she effected her entrance with some plastic material, to prevent the entrance of enemies; the number of eggs is in proportion to the length of the tube—there are generally sixty to seventy. On bursting their shells the young larvæ immediately commence feeding on the last deposits of alburnum. They at first form parallel lines or tubes, which are seen gradually to enlarge and diverge, and are filled with exuviæ. Here they continue to feed during the summer, autumn, and winter (if mild); when full-grown they form a case, in which they change to the pupa state, and then, at the end of May, or the beginning of June, bore their way out through the substance of the bark. . . When the insect greatly abounds, it will perforate the bark of fresh hewn timber; but I have never found one specimen in an elm whose juices were dried up. Therefore, irrespective of the cause of disease, it must be unanimously granted that an insect which can destroy *four square inches* of bark by detaching it from the alburnum, must prove highly destructive, and whilst permitted to remain must frustrate any attempt to restore health. When we find a tree dead, with terminal branches profuse and perfect, we certainly, under ordinary circumstances, should not say that tree had died from defective nutrition in the soil; but that, from some cause or another, it had suddenly, as it were, come to an untimely end; and such a tree we had in the Gardens (Royal Botanic). I watched it in its beauty, and in three years saw it cut down and carried away dead. But what a sight met our view on removing the bark—the surface of the trunk, as many gentlemen will remember, for I exhibited a piece of it three feet long before this Society (Entomological), was beautifully scored by the lateral tubes of the Scolytus larva, and we reckoned that this solitary tree gave birth to no less than the prodigious number of 280,000 perfect insects."

channels figured at B in No. 2, has been styled topographus, or "map maker," from a supposed resemblance in the channels to the lines indicating rivers, etc., on engraved maps. It is a rather larger insect than chalcographus, as shown by the larva tracks, which may easily be compared, as the traces of both are frequently found in the same tree. The channel of another larva of this class has somewhat the appearance of writing, to which it is indebted for its specific title autographus, while others have received equally characteristic names.

Mr. Westwood states that he has often found Hylisinus Fraxini in the elm, though its name would indicate that its ravages were confined to the ash. It is a small beetle, very similar in form to the S. destructor, but it is of lighter colour—the wing-cases being prettily variegated or clouded with a deeper tone. The larva of Hylisinus Fraxini closely resembles that of the genus Scolytus, and is found in a state of activity in the elm during the month of August. The larvæ of another little beetle, enemy of the elm, of the genus Hylargus, very closely resemble those of Scolytus.

We have hitherto described the enemies of the elm among the more minute representations of the beetle tribe. But the British giant of the race—the great stag-beetle, whose conspicuous size and form soon make him well known to the merest tyro among young entomologists—is also, in its larva stage, a formidable enemy of this devoted tree. The larva of this large insect is of proportionate size; and whenever it does attack a tree of this kind, which is fortunately of not frequent occurrence, as the insect is not very abundant, the dangerous nature of its inroads may be easily conceived, as it not only bores into the very heart of the wood, but also, with still more fatal effects, penetrates the main roots in a similar manner. A tree-enemy upon fully as large a scale, is the Cossus Ligniperda—the wood-boring Cossus. This is a large moth, one of the handsomest our British kinds; the caterpillar of which is large, and protected with strong scales, and also furnished with powerful mandibles, which enable it to eat its way into the core of the hardest woods. It prefers, however, the pear and the willow, but is frequently found in the elm and other large forest trees. The damage done by this powerful larva to the trees it attacks may be readily imagined, as it lives from two to three years in the tree before its transformation takes place; and at its full growth leaves a clear bore through the solid wood of from half an inch to three-quarters of an inch in diameter.

There are many interesting circumstances known regarding the habits of the Cossus Ligniperda; but the present paper has reached its extreme limits, which also prevents the description

of many other insects injurious to the elm, both in its healthy and partially-decayed state.

Having examined the habits of certain xylophagous, or wood-eating insects, and having probably arrived at the conclusion that the ravages of the Scolytus and his congeners have a more direct connection with the decay of elm-trees than increased drainage, or any other cause, it is time to consider the seemingly dangerous method of cure proposed and practised by M. Robert, and to ascertain the principles upon which it must have been adopted, and upon the applicability of which its success must depend.

The sap, the basis of which is mere rain-water, that is to say water impregnated with carbonic acid, is taken up by the roots, and ascends between the solid wood and the bark, causing the formation of a coating of new wood all round the trunk, which coating, in its soft state, is termed alburnum. It is again through this alburnum that the surplus sap, vitiated by the functions it has performed, has to descend, eventually escaping through the spongeoles, or fine fibres of the roots, into the earth. Now, if the ascent of the nutritious moisture be impeded by the scoring of the Scolyti, or still worse, if, in its vitiated state, its descent be impeded, and its escape prevented, the most fatal consequences must necessarily ensue in some of the forms caused by the morbid retention of a poison. If, therefore, M. Robert can remove the bark, and with it the Scolyti, giving to the alburnum (relieved by his process from the further injury of its enemies) the opportunity of exerting its reparatory functions, which he asserts that it is able to do even when deprived of its natural protection, the external bark, which, he assumes, it is able to restore, then M. Robert appears to have hit upon a mode of cure which, under favourable circumstances, may prove successful. It is, of course, necessary that in removing the bark care be taken to spare in every way the alburnum. My neighbour Dr. Evans informs me that a goat in his garden had eaten all the *bark* from the lower part of the trunk of a tree to which it was attached, but that not having seriously injured the *alburnum* the reparatory powers of that substance not only repaired its own injuries, but reclothed itself with a coating of bark. And thus it is seen, in "ringing" operations, pursued for the purposes of destroying trees, that the alburnum itself must be cut through, as well as the outer and inner bark, and then, no doubt, in the great majority of cases the tree invariably dies.

It may be stated, in support of M. Robert's theory, that the bark is, speaking by analogy, the *bone*, rather the *skin* of the tree, and bone, as is well known, is the result of a kind of organic action which has to an unusual extent the power of

reproduction. A singular link between the forms of vegetable and animal bone, if one may be permitted the use of such fanciful terms, is to be found in Crustaceæ. The bone of the lobster, for instance, unlike that of the higher forms of animal life, is entirely external, that is to say, what would be the internal spine, etc., in a fish or a quadruped is the *shell* of the lobster. This external casing of bone is not only capable of renewing itself in case of injury, but does so naturally every year, the creature shedding its external bone to allow of the annual growth of the body, which it clothes and protects. The inner coating, analogous to the liber and alburnum of the tree, having not only an inherent power of protection when deprived for a time of their usual external covering, but having also the power of re-clothing themselves with a new one of the same kind, suited in dimension to the increased size of the body. So that we need not be altogether surprised at the reported success of M. Robert in doing for the tree that which the lobster does once a year for itself. It may be added that there is even a "tree lobster," as one may term it, which also does for itself that which M. Robert pretends to do for diseased oaks or elms; that tree, is the well-known oriental plane, which sheds its old bark every year, a circumstance which may partly account for its retaining its health in the very heart of smoky towns, where other trees perish, probably from the clogging of the pores of the bark, and so stopping that necessary expiration which trees carry on by them as well as the leaves. Just as in the human being, the pores of the skin allow of a continuous expiratory action supplemental to that of the lungs. The process of M. Robert, then, may *possibly*, should it be found practicable, be effectual, in permanently checking the ravages of the Scolytus family; but it cannot touch the inroads of the Cossonus, and cannot repair such damages as that effected by the larva of the stag-beetle and the Cossus Ligniperda.

I should add, in conclusion, that I have just received a letter from a botanical physiologist who has entered into direct correspondence with M. Robert, and who, after that correspondence (as before) is decidedly of opinion that the *procédé Robert*, as the French would say, is certain to be fatal to any tree upon which it is fairly put to the test. A series of careful experiments can alone decide the question; and if judiciously carried out, would, no doubt, lead to the elucidation of many facts with which we are at present but imperfectly acquainted.*

* The question raised in this paper is of great interest as a matter of vegetable physiology; but whatever may be the result of further experiments, we cannot endorse the *bone* theory.—Ed.

STAR FINDING.

THERE are few more delightful occupations than paying telescopic visits to the hundreds of beautiful objects which the heavens present, and which are accessible to the possessors of very moderate optical means. A beginner need not be discouraged by the difficulty incidental to the nature of the pursuit. Let him commence with such a work as Mrs. Ward's elegant *Telescope Teachings*,* and he will find himself insensibly prepared for the consideration of more complicated problems, and the prosecution of investigations of a more elaborate kind. Many interesting stars require instruments of considerable magnitude and power, but Mrs. Ward has shown much that may be accomplished with a two-inch glass; and Mr. Webb has furnished a valuable guide to all the principal astronomical wonders that can be reached by objectives up to double that size.† The names of the principal stars in our hemisphere may be learnt from maps, globes, or the excellent planisphere published by Smith in the Strand; but as the constellations are among the most bungling contrivances of human ingenuity, it is by no means an easy task to trace their imaginary boundaries in the sky, or to know exactly where to point the telescope to the less conspicuous members of their bewildering groups. In the papers for which our readers are indebted to Mr. Webb, very simple directions are given for finding, at a specified date the objects which he describes, but, inasmuch as the whole celestial framework appears to revolve about our earth, and each month —each hour—presents a different aspect of the firmament to our gaze, it is very desirable to possess accurate and scientific means adapted to any time, by which, if the weather permits, the object we wish to examine may be infallibly found. Such an aid the professional astronomer possesses in the equatorial, and several opticians have produced equatorial stands adapted for portable telescopes of moderate size. They are, however, from their price beyond the reach of many students, and even if they were cheaper and less cumbersome, they would not answer all the purposes that can be served by a small instrument readily carried from one room to another, or to any part of a garden or field from which a good view can be obtained, and the adjustment of which can be readily made. Such an instrument has been produced by Messrs. Horne and Thornthwaite, and since we first alluded to it in the

* *Telescope Teachings; a Sketch of Astronomical Discovery, containing a Special Notice of Objects coming within the Range of a Small Telescope.* By the Hon. Mrs. Ward. Groombridge and Sons.

† *Celestial Objects for Common Telescopes.* By the Rev. T. C. Webb, Incumbent of Hardwick, Herefordshire. Longmans.

"Notes and Memoranda" of our May number, we have given it repeated trials, and have likewise obtained an excellent report of its merits from a practical astronomer, to whose care we consigned it for several weeks. It consists of a steady bed, shown in the annexed sketch, furnished with two spirit-levels and three adjusting screws. The polar support, *m*, has the slope required by the latitude of the place in which it is to be used, and being fixed by the makers at the right angle, becomes free from error and always ready for work. *a* is the telescope, rotating on an axis and carrying the index *e* to any point of the declination circle *d*; *h* is the hour circle, and *i* its index, moving with the telescope and giving the right ascension in hours and degrees.

If the student has a convenient place commanding a sufficient sky view, he can if he pleases fix the instrument upon a pillar after having adjusted it according to the directions given in an excellent paper issued with it, but in many cases it will be convenient to preserve its portability, and then it must be brought to the right position each time it is employed. If required merely as a finder it will be sufficient to set the two circles for the right ascension, and declination of the pole star as given in the *Nautical Almanack*, or any other ephemeris; the polar support should then be approximately pointed to the star, and the bed accurately levelled by the adjusting screws. If this is properly done a very trifling movement will bring the star into the centre of the field marked by the cross wires, and the instrument will be ready for use. In this way we obtained good results as a finder, and for measurements of position sufficiently near the mark to distinguish and ascertain the name of any star not easily confounded with its near neighbours. This mode of proceeding has certain obvious advantages, but every possessor of the instrument should accustom himself to use it from one particular situation where he has obtained a good meridian line,

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and can adjust it so as to work with the greatest accuracy of which it is susceptible. The method of doing this is clearly explained in Messrs. Horne and Thornthwaite's paper of directions, and many of our readers will remember the information furnished by Mr. Burder in the articles published in *Recreative Science* on a portable equatorial.

The student will gladly avail himself of this instrument (1) to find stars, or other objects he wants to look at; (2) to discover the name of any star by determining its exact position, and then ascertaining from an almanack or chart what body it must have been to have occupied such a position at such a time; (3) to obtain the time within a few seconds by watching the transit of any star convenient for such a purpose. It also possesses a high educational value, affording to teachers the means of giving their pupils an initiation into many processes of practical astronomy that ought not to be neglected in any civilized school.

The construction of the star-finder displays considerable skill. To render such an instrument generally useful, it was necessary to make it handy, cheap, and not easily deranged, and in these several particulars Messrs. Horne and Thornthwaite have succeeded extremely well. The telescope, although small, is of excellent quality, giving a good view of Jupiter's moons, and clearly showing ϵ Lyra as a double star, on a bright summer's night. The movements are smooth and steady, the graduation accurate, and every part firm and strong. Thus the student will find it an excellent aid to his fascinating pursuit.

DE LA RIVE ON THE AURORA BOREALIS.*

M. DE LA RIVE conceives that two general facts relating to the aurora are established: 1st, "the coincidence between the appearance of the Boreal and the Austral Auroras: 2nd, that auroras are atmospheric phenomena which take place within the limits of the atmosphere, but not beyond it." He seeks to show that the positive electricity carried to high regions of the atmosphere by vapours from tropical seas, and which the trade winds accumulate near the polar regions, acts by induction on the negative electricity with which the earth is charged. There results, he says, "a condensation of contrary electricities in those portions of the earth and the atmosphere which are nearest each other, and in consequence a neutralization in the

* *Comptes Rendus*, June 9, 1862, p. 1171. A similar account is given in the *Archives des Sciences* (Genève), No. 54, and accompanied with a drawing of the apparatus.

neighbourhood of the poles, which takes place under the form of more or less frequent discharges as soon as their tension has reached a limit which cannot be maintained. These discharges ought to take place simultaneously at both poles, since, as the conducting power of the earth is perfect, its electrical tension ought to be sensibly the same, with some slight differences arising solely from accidental variations in the stratum of air interposed between the two electricities. There are thus upon the earth during the appearance of the auroras two currents proceeding from the poles to the equator; but if the discharge only takes place at one pole—the southern for example—there is no longer in the northern hemisphere a current directed from north to south, but a weaker current directed from south to north. This change gives an eastern declination to the compass-needle instead of the western declination which occurs when the boreal discharge takes place and the current is directed from north to south."

"It is known that auroras are accompanied by more or less intense currents in telegraphic wires. Mr. Walker in England, and Mr. Loomis in America, have made them the subjects of special study, and they have found that they vary constantly not only in intensity but likewise in direction, coming alternately from north to south, and from south to north. If we remember that the currents propagated by telegraphic wires are derivative currents gathered by means of large metallic plates sunk in the moist soil, it will appear that these plates are not slow to polarize themselves under the chemical action of the current which they transmit, and that they ought to determine in the wire which unites them an inverse current as soon as that which occasioned their polarization ceases or diminshes its force; and all observers know that the auroras exhibit a very variable and perpetually oscillating light."

"The change which occurs in one terrestrial current when the discharge passes from one pole to another—from the north to the south, for example—determines also a change in the direction of the currents of the telegraphic wires, which in that case flow from south to north, instead of from north to south; but the new current is much weaker than the old one, except when it unites with the secondary currents arising from the plates."

"There is, however, a great difference in the results obtained when, instead of observing the currents collected by telegraphic wires, we study the perturbations of the magnetic needle which accompany auroral manifestations, as in the latter case there are neither electrodes nor secondary currents, but only one direct action of the principal current. This current may vary in intensity, but it must always operate in the same way (*même*

sens) while the discharge takes place at the same pole, whether it be strong or weak, and it will not change its character until the discharge nearly ceases at the nearest pole, in order to operate almost exclusively at the other; whilst by reason of the effect of secondary polarities a change in intensity suffices to produce a change of direction in the currents of telegraphic wires. This difference is strikingly shown by comparing the graphic representations of purturbations in the magnetic needle observed by Mr. Balfour Stewart at Kew, during the auroras of the 2nd September, 1859, with the results of Mr. Walker's observations of the currents exhibited by telegraph wires at the same time. I have succeeded in experimentally verifying these observations by transmitting the discharge of a Ruhmkorff's coil through rarefied air, placing in the circuit some water holding a little salt in solution, and in which two plates of metal were immersed. As soon as the principal current was weakened or stopped the inverse current was exhibited by the plates."

"In order to reproduce all the details of the natural phenomena, I caused an apparatus to be constructed composed of a sphere of wood about ten inches in diameter, which represented the earth, and carried at each pole a bar of soft iron about two inches long, and about one inch in diameter. Each bar rested on a vertical cylinder of soft iron to which it was united, and thus the sphere was supported. So arranged, the sphere had a horizontal axis terminating in two appendages of soft iron which could be magnetized by bringing the two cylinders on which they rested in contact with the poles of an electro-magnet, or by surrounding the cylinders with coils of wire traversed by electric currents. Each of the iron bars was surrounded by a glass cylinder (*manchon*) between five and six inches in diameter, and about seven inches long, and in which it occupied an axial position projecting into the middle of the glass. The two vessels were hermetically sealed by two metallic caps, one of which was traversed by the iron bar, while the other carried a metal ring upon two arms, the centre of the ring coinciding with the end of the iron bar, and having its plane perpendicular to the axis of one bar. The diameter of the ring is a little less than that of the glass. Stopcocks were conveniently placed to allow of a vacuum being formed in the glass vessels, and any kind of gas introduced.

"To use this apparatus, the wooden ball is covered with two strong bands of bibulous paper, one occupying its equator and the other crossing it from pole to pole, and making contact with the two bars of iron. On this last band, pieces of copper about one or two-thirds of an inch square are fixed at equal intervals with copper tacks that penetrate the wood. All the

copper squares are arranged in the same meridian. Between two of the squares a metallic communication is established with the thread of a galvanometer placed about twelve yards off, so that its needle shall not be directly influenced by the electro-magnet. Having thus arranged the apparatus, the paper bands are moistened with salt and water, and the equatorial band is connected with the negative electrode of a Ruhmkorff's coil, which has its positive electrode brought into communication, by means of a bifurcated wire, with the two metallic rings which are inside the glass vessels, and in highly rarefied air. The discharge is soon seen as a luminous jet between the rings and the extremity of the iron bar, sometimes in one vessel, sometimes in the other, but rarely in both at once, although both are placed under apparently the same circumstances."

"As soon as the soft iron is magnetized, the jet spreads and forms an arc round the central wire, animated by a rotary movement, the direction of which depends on the character of the magnetization. It is evident that it depends also on the direction of the discharge, but we have supposed this direction constant, and resembling that of nature, that is to say, directed from the circumference towards the centre. It is important to notice that if the air be not too rarefied, a moment is observed in which, when the iron bars are magnetized, the rotation begins, and the jet not only expands into an arc, but darts brilliant rays that remain quite distinct from each other, and turn round with greater or less velocity like the spokes of a wheel. In this we see an exact representation of what occurs in the aurora borealis, when the luminous arcs being all impressed with a movement of rotation from west to east, dart luminous jets in the higher regions of the atmosphere. These jets do not occur unless the iron is magnetized, and they may be stopped if the air is highly rarefied, by introducing a vaporizable liquid, such as a drop of water. It is impossible to produce them if the discharge, instead of being directed, as in nature, from the circumference to the centre, passes in an opposite direction."

M. de la Rive adds, that on examining the galvanometer with which the two wires previously mentioned are in communication, a secondary current will be indicated, its character and direction being determined by whether the discharge takes place at one pole or the other; and he states that he can imitate the disturbances which the magnetic needle experiences when the auroras occur.

CURIOUS ILLUSTRATION OF VEGETABLE MORPHOLOGY.

It is not uncommon for natural objects to assume somewhat extraordinary forms, but perhaps few are more curious than the one which I have endeavoured to represent in the accompanying sketch. This singular freak of nature was shown to me at the house of some friends with whom I have been recently staying, and was cut from an ash-tree in a wood near Reculver, in Kent. The branch suddenly assumes a flattened form, and shortly after separates into two branches, which bear at first sight a curious resemblance to the antlers of a stag. Buds appear at short intervals, some of them with an approach to regularity in their arrangement, others in clusters. The two arms, after division, are not exactly in the same plane, the small one being slightly foreshortened when the large one is in full view. My drawing, though somewhat rough, is, I believe, accurate, being made from a pencil sketch and description which I took from the object itself. I neglected at the time to take the actual measurements, but the length of the large arm is scarcely less than eighteen inches. As an example of the curious in nature you may possibly deem it worthy of a notice in the Intellectual Observer.

Robert Gausby.

THE NEW METAL THALLIUM.

On the 19th June Mr. Crookes read a paper on the new metal thallium, before the Royal Society, and on the 25th of the same month M. Lamy made a similar communication to the French Academy. It is from these sources that we are able to lay before our readers the following particulars:—In March 1861, Mr. Crookes announced that a brilliant green line, exhibited by some selenium residues, in the spectroscope method of analysis, was an intimation of the existence of a new element. In the following May he gave a further account of his discovery, and named it *thallium* from our Greek θαλλος, on account of its coloured line resembling the hue of vigorous vegetation. M. Lamy, who was not aware of Mr. Crookes's investigations, made a subsequent but independent discovery of the same green ray, which he noticed in the spectrum of a specimen of selenium extracted by M. F. Kuhlmann from the refuse of chambers in which sulphuric acid had been prepared by the combustion of pyrites. Both chemists set to work to isolate the new metal; Mr. Crookes operating with crude sulphur distilled from Spanish pyrites, and containing thallium to the extent of one or two grains in the pound; while M. Lamy used the selenium previously mentioned, from which he obtained salts of thallium that gave up that metal by voltaic action. Mr. Crookes's process will be found in the *Chemical News*, July 5th. In substance it consists in dissolving the metals out of crude sulphur or pyrites by strong hydrochloric acid, to which nitric acid is gradually added. The solution is evaporated to drive off the nitric acid, and a little sulphuric added if required. It is necessary to stop the evaporation before the solution becomes pasty. It is then diluted, gently heated, filtered, rendered alkaline with carbonate of soda, treated with an excess of cyanide of potassium free from sulphide of potassium, heated once more, and filtered again. It is in the solution left after these processes that the thallium remains, which is precipitated by sulphuretted hydrogen. If cadmium and mercury are present, warm dilute sulphuric acid will remove the former, and the sulphides of thallium and mercury are separable by dilute nitric acid, which dissolves the first, and leaves the last. The nitric acid solution is evaporated to dryness, the residue dissolved in hot sulphuric acid, and the thallium precipitated by a piece of pure zinc. Thus obtained, the new metal looks first like a deep brown powder, which soon changes to a heavy black granular precipitate, to which fusion in hydrogen gives a coherent form.

Thallium bears a strong physical resemblance to lead. Its

specific gravity is about 12, that of lead being 11·36. Mr. Crookes says it is not so blue as lead, and M. Lamy describes it as less white than silver, and resembling aluminium in hue. A fresh cut surface has a brilliant lustre, which tarnishes quicker than lead. It is soft enough to be scratched with the nail, and very malleable, but possessed of little tenacity. It readily marks paper, leaving a trace "with yellow reflexions." M. Lamy also states that it becomes yellowish if rubbed with a hard substance, a change which he attributes to oxydation. It is so sensitive in the spectroscope that the last named authority affirms that it may be discovered in one fifty millionth of a gramme of one of its compounds. Mr. Crookes describes two oxides of thallium, and thinks that a third is probably formed. To one he ascribes basic properties, and we presume it is that which is formed when the metal tarnishes, and which M. Lamy states to be alkaline, with an odour like that of potash. The next oxide, containing more oxygen, Mr. Crookes names thallic acid, which may be obtained in a crystalline form.

Iodine, bromine, sulphur, and phosphorus can unite with the new metal, and it combines with sulphuric, carbonic, chromic, phosphoric, and other acids.

M. Lamy exhibited to the French Academy an ingot of thallium weighing fourteen grammes, obtained by a Bunsen battery from chlorides which he formed by chemical means. The new metal is far from rare, and is very likely to be extracted in sufficient quantities to serve some economic use. Its spectroscope properties are highly important. In the words of Mr. Crookes, "The green line of the thallium spectrum appears to be unaccompanied by any line or band in other parts of the spectrum. A flame of sufficient temperature to bring the orange line of lithium into view produces no addition to the one thallium line; and an application of telescopic power strong enough to separate the two sodium lines a considerable distance apart, still shows the thallium line single. I consider, therefore, that I am justified in stating that thallium produces the simplest spectrum of any known element. Theoretical inquiries into the cause of the spectrum lines, and their relation to other constants of an element may be facilitated when we know a metal which gives rise to luminous vibrations of only one degree of refrangibility. The remarkable simplicity of the thallium spectrum offers a strong contrast to the complicated spectra given by mercury, bismuth, and lead, the metals to which it has most chemical resemblance."

XUM

ARTIFICIAL HALOS.

EVERYONE who has used an air-pump has noticed the clouds of vapour which form in the receiver after a few strokes of the piston, and which arise from the air yielding up a portion of its moisture as the pressure is diminished. If these vapours are viewed by light transmitted from a candle, prismatic colours will appear; but to insure a distinct and fine halo Mr. Slack recommends the following plan: Place a large receiver on the principal plate of an air-pump, and a small one, holding about a quarter as much as the former, on the smaller plate. Turn the stopcock so that when the pumps are worked the small receiver only shall be exhausted, the large one remaining full. When a vacuum has been made, place a taper on one side of the large receiver, and stand on the other, keeping the eye on a level with its light, and suffering no other illumination in the room. Now, suddenly turn the stopcock so that a portion of the air from the large receiver shall rush to the exhausted smaller one. At this moment a splendid halo will appear, and it is an interesting and by no means an easy task to notice the exact order in which the colours are exhibited. The average decision arrived at in one set of experiments was as follows: A yellow light seemed to rush from a circumference to a centre, forming a luminous disk, which passed instantly to a red-orange hue, and then to a brilliant emerald-green. At this point the green central disk appeared to expand outwardly and take the form of an external ring, the centre resuming an orange tint. The changes in the phenomenon are exceedingly rapid, and their duration so infinitesimal that it is impossible to note and describe all the chromatic effects, among which some rich purple rings will be observed, before the luminous circles disappear. Those who wish to perform the experiment with an air-pump that has only a single plate should connect its receiver by a pipe and stopcock with a larger closed vessel full of air, and then proceed in the manner described. A large amount of light is injurious to the results, as it overpowers the coloured rays. If the experiment were performed on a large scale it would probably be effective in a lecture-room.

Under ordinary circumstances there is enough moisture in the air to give rise to pleasing effects; but they will become more striking if a few drops of water are sprinkled on the inner surface of the large receiver. It is also interesting to notice the variations that occur if alcohol or liquid ammonia be substituted for the water. In the latter case, the clouds formed are denser and less evanescent.

XUM

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1862.	Reduced to mean of day.					Temperature of Air.			At 9·30 A.M.; 2 P.M.; and 5 P.M. respectively.		
			Calculated.								
Day of Month.	Barometer, corrected to Temp. 32°.	Temperature of Air.	Dew Point.	Relative Humidity.	Tension of Vapour.	Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	Proportion of Sky clouded.	Direction of Wind.	Rain, read at 9·30 A.M.
	inches.	°	°		inch.	°	°	°			inches
April 1	29·854	46·9	43·5	·89	·298	53·2	41·2	12·0	10, 10, 10	SW by W, SW by S, SSW.	·063
„ 2	29·629	48·0	40·9	1·00	·372	54·9	49·4	5·5	10, 10, 10	SSW, S by W, S.	·027
„ 3	29·672	49·6	43·6	·81	·299	58·3	48·1	10·2	3, 7, 4	SW by W, WSW, WSW.	·268
„ 4	30·074	44·4	39·6	·84	·260	53·2	45·0	8·2	10, 9, 6	N, W, —	·000
„ 5	30·000	45·2	45·0	·99	·314	54·3	44·2	10·1	8, 10, 10	S by W, SSW, SW by S.	·000
„ 6	...	...	...	...	...	54·5	49·4	5·1	...	...	·038
„ 7	30·171	44·5	45·4	1·00	·319	51·5	47·6	3·9	10, 10, 10	NNE, NNE, N.	·262
„ 8	30·237	40·3	40·5	1·00	·269	46·0	42·6	3·4	10, 10, 10	NE by N, NE by N, ENE.	·005
„ 9	30·048	40·5	41·1	1·00	·275	47·0	41·1	5·9	10 10, 10	NNE, N, N by W.	·780
„ 10	29·946	43·1	43·0	1·00	·293	51·5	42·3	9·2	10, 10, 10	NW, NE by E, N.	·670
„ 11	30·173	36·9	33·6	·89	·211	45·0	41·1	3·9	10, 10, 10	NE, NE, N by E.	·004
„ 12	30·253	34·4	18·6	·57	·123	42·2	30·7	11·5	2, 7, 4	N by E, N by W, NW.	·002
„ 13	...	...	...	...	...	43·8	29·1	14·7	...	...	·000
„ 14	30·098	37·8	24·8	·63	·154	45·2	29·2	16·0	6, 10, 10	NW by W, WNW, NW by W.	·000
„ 15	30·128	38·3	30·8	·75	·185	46·1	33·6	12·5	10, 7, 7	NE, NNE, NE by N.	·000
„ 16	30·080	42·7	34·5	·75	·218	49·8	29·0	20·8	8, 10, 10	W by S, WSW, SW by W.	·000
„ 17	29·855	46·4	31·4	·59	·195	54·7	44·1	10·6	2, 7, 3	NW, WSW, W.	·000
„ 18	...	...	...	...	...	55·4	41·8	13·6	...	...	·035
„ 19	29·822	49·6	44·8	·85	·312	56·1	48·0	8·1	9, 10, 9	SW, SW, SW.	·000
„ 20	...	...	...	...	...	58·9	50·1	8·8	...	...	·004
„ 21	29·973	53·3	46·5	·79	·331	61·1	45·7	15·4	6, 9, 9	SW by W, SW, SW by S.	·000
„ 22	29·628	50·8	43·6	·78	·299	59·5	46·3	13·2	9, 10, 4	SW by S, SW by S, SSW.	·000
„ 23	29·756	50·7	38·1	·65	·247	58·9	46·7	12·2	7, 6, 6	WSW, WSW, W.	·096
„ 24	29·967	53·7	41·6	·66	·279	61·6	44·3	17·3	8, 3, 3	SSE, S by E, S by E.	·020
„ 25	29·838	61·0	53·6	·78	·422	70·5	45·6	24·9	9, 9, 2	SSW, SW, SW.	·060
„ 26	29·886	57·4	50·4	·79	·378	64·8	51·2	13·6	10, 7, 8	SE by S, WSW, WSW.	·229
„ 27	...	...	...	...	...	62·4	42·8	19·6	...	...	·012
„ 28	30·150	57·7	45·4	·66	·319	65·7	41·4	24·3	2, 3, 1	E by S, —, NNW.	·000
„ 29	30·243	55·0	41·0	·62	·274	62·9	39·1	23·8	0, 0, 0	E by S, E, E.	·000
„ 30	30·028	58·6	43·8	·60	·302	66·3	44·9	21·4	0, 0, 2	SE by S, NE by E, E.	·000
Monthly Means.	29·980	47·5	40·5	·80	·278			12·7	...	...	2·577

HOURLY MOVEMENT OF THE WIND (IN MILES) AS RECORDED BY ROBINSON'S ANEMOMETER.

APRIL 1862.

Day.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Hourly Means.
Hour.																																
12		7	23	16	3	4	16	5	11	12	8	12	17	4	4	4	1	18	9	14	16	4	5	18	12	4	2	4	3	3	13	9·1
A. M. 1		8	21	16	7	4	19	4	9	10	5	13	15	4	5	4	2	18	8	12	13	5	7	18	11	2	5	4	2	2	16	9·0
2		8	22	10	5	4	19	4	14	9	3	14	14	4	5	4	1	16	7	11	13	4	8	16	7	2	3	2	3	3	10	8·2
3		9	24	9	3	6	19	3	13	12	4	12	13	6	5	5	4	15	7	15	11	5	6	17	7	1	5	4	1	2	11	8·5
4		8	26	5	5	5	23	0	13	12	5	13	11	6	7	5	3	15	7	16	11	11	8	19	7	3	7	4	1	3	9	8·9
5		8	27	5	4	6	21	2	15	15	4	16	14	7	4	5	2	14	7	17	11	8	13	18	4	2	6	4	2	5	11	9·2
6		6	25	10	6	9	23	6	19	15	3	19	19	7	3	5	4	11	9	15	12	8	14	18	6	3	5	3	1	8	19	10·4
7		14	32	8	8	8	24	9	15	17	4	20	22	12	9	9	5	20	11	20	13	14	19	19	10	3	5	5	2	10	18	12·8
8		17	27	7	9	12	19	11	17	18	4	21	23	14	8	11	7	20	12	19	14	15	25	19	13	3	3	5	3	13	20	13·6
9		18	28	8	7	15	21	11	16	13	4	21	20	14	12	17	11	17	15	21	17	16	21	24	15	6	7	6	3	17	17	14·6
10		12	26	10	8	21	22	8	15	15	3	22	16	17	13	17	13	15	15	28	17	14	26	20	17	7	9	7	4	20	21	15·3
11		16	27	10	7	24	19	7	16	17	3	22	16	19	15	20	19	15	20	25	19	12	24	22	21	7	18	11	7	20	25	16·8
12		18	27	11	5	25	18	9	16	14	6	24	14	17	14	17	18	17	17	25	16	13	25	27	21	8	19	9	5	25	24	16·8
P. M. 1		24	26	10	6	25	16	8	15	14	4	27	14	19	13	19	20	14	18	26	18	13	27	27	21	7	19	10	6	26	26	17·3
2		24	24	14	7	23	16	9	16	12	2	25	13	19	11	17	21	15	21	24	18	17	27	26	20	8	18	8	4	28	27	17·1
3		26	22	13	5	23	19	8	15	9	2	26	14	20	11	17	21	15	24	25	16	16	26	24	17	9	15	6	6	26	18	16·5
4		23	23	7	4	24	15	10	15	10	3	25	14	19	11	15	20	17	22	30	17	16	27	26	17	14	14	7	4	28	17	16·5
5		27	22	9	2	22	16	9	14	3	5	25	10	12	9	12	20	14	21	25	16	14	24	22	11	12	12	5	6	27	15	14·7
6		26	20	9	1	18	14	9	16	10	6	20	5	10	6	8	20	14	18	25	12	10	23	18	6	10	8	2	4	25	11	12·8
7		26	23	5	2	20	10	10	13	12	9	26	5	5	5	2	20	9	19	25	8	9	22	14	7	10	7	2	8	25	12	12·3
8		24	25	6	2	18	9	9	13	10	12	23	4	6	5	3	19	10	16	21	10	7	20	10	4	6	8	3	2	25	15	11·5
9		26	25	3	2	20	7	11	15	9	11	15	2	11	5	5	19	7	15	22	14	7	20	7	5	6	7	4	1	18	12	11·0
10		24	30	5	1	22	7	11	13	7	10	18	4	12	3	5	22	9	14	21	9	10	19	9	4	6	6	5	3	18	10	11·2
11		19	34	4	3	17	6	9	10	9	16	20	3	8	4	3	18	5	15	19	5	7	16	11	5	4	5	3	1	15	8	10·1
12																																
Total Daily Movement.		418	609	210	112	375	398	182	344	284	136	479	302	272	187	229	310	340	347	501	326	255	452	449	268	143	213	123	82	392	385	12·7

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1862. Day of Month.	Reduced to mean of day.					Temperature of Air.			At 9·30 A.M., 2 P.M., and 5 P.M., respectively.		Rain—read at 9.30 A.M.
	Barometer corrected to Temp. 32.	Temperature of Air.	Calculated. Dew Point.	Relative Humidity.	Tension of Vapour.	Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	Proportion of Sky clouded.	Direction of Wind.	
	inches.	°	°		inch.	°	°	°			inches.
May 1	29·936	62·3	53·7	·75	·423	72·1	51·0	21·1	10, 1, 1	S, SSW, S by W.	·032
„ 2	30·193	51·4	42·1	·73	·428	59·3	50·6	8·7	9, 2, 1	W, N, N.	·018
„ 3	30·067	42·7	41·0	·94	·274	49·5	40·2	9·3	10, 10, 10	ENE, E, E by N.	·005
„ 4	...	...	...	...	...	71·5	44·9	26·6	...	...	·000
„ 5	29·961	62·8	52·9	·72	.412	71·2	44·9	26·3	8, 4, 1	WSW, SSE, S by E.	·128
„ 6	30·010	65·1	53·8	·69	.425	74·8	54·9	19·9	9, 8, 6	N by E, NNW, NW by W.	·008
„ 7	29·748	52·3	51·1	·96	.387	63·6	54·5	9·1	8, 10, 10	WNW, SW by W, SW.	·756
„ 8	29·904	53·6	46·2	·78	.328	61·4	48·5	12·9	7, 7, 9	SW, SSW, SSW.	·727
„ 9	29·612	48·5	46·8	·94	.334	58·5	47·2	11·3	8, 10, 8	SW, SW, SW by S.	·620
„ 10	29·618	49·8	43·9	·82	·303	60·1	48·6	11·5	10, 8, 5	WSW, SW by W,—.	·180
„ 11	...	...	...	...	...	57·5	47·7	9·8	...	...	·149
„ 12	29·610	51·1	42·0	·73	·283	57·2	46·4	10·8	8, 10, 9	N, —, E by S.	
„ 13	29·891	48·6	40·9	·77	·273	58·1	45·4	12·7	10, 9, 7	NE by N, NNE, N.	·000
„ 14	29·867	47·0	42·0	·84	·283	53·7	39·6	14·1	8, 10, 10	NE, ENE, NE.	·000
„ 15	29·879	44·3	44·2	1·00	·306	53·7	44·5	9·2	10, 10, 10	NNE, N, N by W	·150
„ 16	29·898	52·6	50·9	·94	·385	61·5	47·0	14·5	10, 10, 3	NNW, NW, W.	·456
„ 17	30·132	60·1	47·6	·65	·344	69·2	45·5	23·7	0, 7, 7	WSW, W, NW,	·000
„ 18	...	...	...	...	...	72·6	47·6	25·0	...	...	·000
„ 19	30·015	62·9	56·1	·80	·459	75·3	47·8	27·5	0, —, 7	W by S,—, S	·000
„ 20	29·716	55·9	44·1	·67	·305	65·3	47·4	17·9	8, 9, 6	S by E, SW by S, SW by W.	·000
„ 21	29·493	43·3	39·7	·88	·261	57·3	46·3	11·0	10, 10, 10	SSW, W, WSW,	·011
„ 22	29·770	51·4	34·6	·56	·219	60·2	39·6	20·6	7, 6, 9	W, W, W.	·200
„ 23	29·761	53·7	52·3	·95	·404	63·6	49·5	14·1	10, 10, 10	SW, SW by S, SSW.	·016
„ 24	29·949	54·2	45·7	·75	·322	63·4	51·1	12·3	10, 10, 10	W by S, SW by W, SW by S.	·013
„ 25	...	...	...	...	...	61·3	45·6	15·7	...	...	·000
„ 26	30·074	57·0	42·5	·61	·288	64·3	43·1	21·2	6, 7, 4	W, WSW, SW.	·000
„ 27	29·880	53·9	52·7	·96	·400	61·3	51·7	9·6	10, 9, 10	SW, SW by S, W.	·090
„ 28	29·886	57·4	55·5	·94	·450	66·0	54·5	11·5	10, 10, 10	SW, WSW, SW.	·038
„ 29	29·795	60·0	55·3	·85	·447	68·5	55·6	12·9	6, 9, 10	ENE, SE by E, E.	·020
„ 30	29·445	57·3	55·7	·95	·453	65·7	57·2	8·5	10, 9, 10	E by N, SSE, SSE.	·030
„ 31	29·937	55·3	49·9	·83	·372	63·9	54·4	9·5	10, 10, 9	W by N, W by S, W by N.	·126
Monthly Means.	29·854	53·9	47·5	·82	·349			15·1			3·775

HOURLY MOVEMENT OF THE WIND (IN MILES) AS RECORDED BY ROBINSON'S ANEMOMETER—MAY 1862.

Day.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Hourly Means.
Hour.																																
12	8	16	12	20		6	13	16	1	17	8	5	7	5	12	7	5	3	1	1	9	6	13	11	5	4	10	5	5	}	8	8·4
1	4	13	13	20		8	6	17	2	12	5	2	8	7	13	8	3	1	0	2	8	5	13	9	5	5	4	10	4	}		7·5
2	6	12	9	18		5	3	12	3	13	7	2	7	7	15	4	5	0	1	1	5	7	18	7	7	3	11	12	5	18		7·7
3	6	13	7	22		7	6	12	1	13	8	3	6	5	16	6	5	1	1	3	10	8	15	11	5	2	11	12	5			7·9
4	9	12	9	18		6	7	17	2	14	6	3	12	4	14	5	5	0	1	2	9	12	22	9	6	4	14	10	5	67	71	8·5
5	4	12	10	17		3	3	13	7	14	4	1	11	9	13	5	2	1	0	2	6	10	20	8	7	4	10	8	4			7·4
6	2	11	10	20		2	10	15	7	17	7	1	14	10	17	7	3	2	1	2	10	15	20	8	9	5	14	11	4	20		9·4
7	7	11	20	20		6	5	23	5	14	9	2	15	13	18	6	5	3	1	5	11	16	22	10	12	5	15	9	6	25		11·0
8	8	14	21	15		3	7	22	10	13	8	2	17	15	22	7	1	2	1	6	13	20	20	10	10	8	16	10	5	17	12	11·2
9	11	14	23	15		3	8	25	12	15	8	4	16	15	20	7	3	3	3	12	11	17	20	9	9	11	15	11	7	13	10	11·7
10	5	14	22	15	7	4	4	22	13	13	9	5	15	15	15	6	5	3	5	16	5	21	20	10	10	10	17	10	7	18	8	11·2
11	7	13	26	10	7	6	4	24	21	20	12	6	15	18	15	6	6	4	3	17	17	19	23	10	10	11	18	11	10	9	8	12·5
12	10	10	27	17	11	8	7	27	26	15	9	2	13	17	13	5	4	5	5	18	13	18	23	11	11	10	18	10	13	13	9	12·8
1	16	11	30		13	6	15	25	23	15	12	1	11	16	13	9	3	4	6	21	12	20	22	12	10	14	15	7	13	11	9	13·2
2	19	14	30		15	3	14	25	24	12	12	1	14	14	15	9	5	5	4	23	11	19	19	11	8	13	15	5	17	13	6	13·2
3	17	11	32		17	7	13	22	23	11	12	3	15	13	14	8	5	4	9	21	10	16	19	11	9	15	15	5	14	13	7	13·0
4	16	10	31		15	9	18	18	18	14	11	5	16	14	12	9	5	7	7	20	20	14	24	12	8	11	13	8	21		4	13·4
5	12	11	30		10	10	18	15	15	13	9	7	16	16	10	9	5	3	11	20	10	16	17	13	7	9	14	10	20		5	12·4
6	12	9	30		10	12	17	10	15	12	6	3	13	14	14	6	5	4	7	14	14	14	18	10	4	10	13	11	22		4	11·5
7	11	10	35		8	10	10	8	15	8	4	2	14	16	17	5	3	3	5	13	9	13	15	5	3	7	10	11	26	77	1	10·0
8	12	9	32		7	13	13	7	12	7	5	8	10	14	14	3	4	2	4	9	12	8	10	7	2	6	9	8	21		3	9·3
9	10	7	32	118	12	9	12	7	18	8	5	9	8	11	11	5	3	1	3	13	12	14	12	7	2	7	10	7	18		6	9·6
10	14	11	31		14	8	18	5	15	8	4	6	11	12	10	5	2	1	3	13	8	13	12	6	3	10	13	7	}		4	9·5
11	13	13	22		8	12	15	2	15	7	4	7	7	10	5	5	5	1	0	13	4	12	16	6	4	10	7	5	73	9	4	8·3
12																																
Total Daily Movement.	239	281	544	499		166	246	389	303	305	184	90	291	290	338	152	97	63	82	267	249	333	433	223	166	192	312	217	645		179	9·7

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1862.	Reduced to mean of day.					Temperature of Air.			At 9·30 A.M., 2 P.M., and 5 P.M., respectively.		
			Calculated.								
Day of Month.	Barometer, corrected to Temp. 32°.	Temperature of Air.	Dew Point.	Relative Humidity.	Tension of Vapour.	Maximum, read at 9.30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	Proportion of Sky clouded.	Direction of Wind.	Rain—read at 9·30 A.M.
	inches.	°	°		inch.	°	°	°			inches.
June 1	...	...	...	...	...	67·4	50·8	16·6	...	...	·003
„ 2	30·043	57·5	48·6	·74	·356	72·0	47·0	25·0	0, 1, 7	W by N, W by N, W.	·000
„ 3	30·019	54·1	51·3	·91	·390	63·7	54·5	9·2	9, 10, 9	SSW, SW, SSW.	·000
„ 4	30·112	57·9	44·7	·64	·311	68·0	45·9	22·1	4, 3, 1	WSW, SSW, S by E.	·015
„ 5	29·719	50·7	47·3	·89	·340	61·9	47·2	14·7	9, 10, 10	SW, W by S. SW by S.	·000
„ 6	29·638	56·2	53·5	·91	·420	64·8	53·5	11·3	6, 10, 10	S by W, S by W, S by W.	·302
„ 7	29·763	57·8	46·4	·68	·330	66·7	36·6	30·1	3, 3, 10	SW, SW by S, SW by S.	·026
„ 8	...	...	...	...	...	65·9	51·2	14·7	...	...	·056
„ 9	29·973	53·2	44·7	·75	·311	61·9	44·2	17·7	6, 7, 3	SW by W, WSW, SW.	·047
„ 10	29·894	52·3	41·4	·69	·277	63·0	42·1	20·9	6, 10, 10	S, SSE, S by E.	·098
„ 11	29·377	54·8	49·9	·85	·372	64·6	50·7	13·9	3, 9, 5	SSE, S by E, S by W.	·070
„ 12	29·293	50·8	51·8	1·00	·397	60·1	52·0	8·1	10, 10, 10	SE by S, S by E, S.	·213
„ 13	29·564	51·4	50·0	·95	·373	62·5	52·2	10·3	8, 9, 7	SW, SW by S, SW by S.	·445
„ 14	29·658	49·5	51·3	1·00	·390	60·1	49·9	10·2	8, 8, 10	SW, SSW, S by W.	·076
„ 15	...	...	...	...	...	63·8	45·3	18·5	...	...	·408
„ 16	29·976	51·2	46·3	.85	·329	64·6	49·6	15·0	7, 9, 10	WNW, NW, —.	·246
„ 17	30·009	56·0	46·9	·73	·336	65·7	47·8	17·9	5, 10, 10	WSW, W, NW by W.	.040
„ 18	29·969	50·8	43·8	·79	·302	61·5	50·3	11·2	3, 9, 8	N by E, N, N by W.	·093
„ 19	30·050	52·3	42·5	·71	·288	61·4	48·4	13·0	9, 10, 10	NW, WNW, SW,	·047
„ 20	29·900	49·9	44·3	·82	·307	58·4	50·2	8·2	7, 10 10	NW by W, WNW, W.	·037
„ 21	29·756	52·2	46·1	·81	·326	60·4	50·5	9·9	10, 10, 10	W by S, SW, W.	·000
„ 22	...	...	...	...	...	60·3	51·9	8·4	...	...	·001
„ 23	29·872	54·4	44·9	·72	·313	65·4	52·8	12·6	10, 6, 3	SW by S, NNW, NW by W.	·076
„ 24	29·928	57·1	51·5	·83	·393	68·0	47·8	20·2	10, 9, 8	WSW, SW, NW by W.	·000
„ 25	30·135	53·5	47·4	·81	·341	63·3	49·8	13·5	10, 10, 7	NW by N, NNE, NE.	·000
„ 26	30·003	57·4	49·6	·77	·368	67·4	50·4	17·0	8, 8, 10	W, NW, W by S.	·000
„ 27	29·769	51·1	40·1	·69	265	67·3	51·7	15·6	9, 10, 7	W by S, W by S, W.	·000
„ 28	29·905	52·6	43·4	·73	·297	61·9	44·6	17·3	7, 8, 8	NW, WSW, NW.	·010
„ 29	...	...	...	...	...	64·0	43·8	20·2	...	...	·000
„ 30	29·910	53·7	39·2	·61	·257	64·3	53·3	11·0	8, 7, 3	NW by N, NW, W.	·057
Monthly Means.	29·850	53·5	46·7	·80	·336			15·1			2·366

HOURLY MOVEMENT OF THE WIND (IN MILES) AS RECORDED BY ROBINSON'S ANEMOMETER.—June 1862.

Day.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Hourly Means.
Hour.																																
12		2	2	7	7	7	5	27	11	5	6	14	17	21	16	7	3	2	7	5	5	5	9	7	5	2	2	4	9	5	9	7·8
A.M. 1		3	6	7	8	4	4	24	11	2	5	14	17	20	18	7	5	3	8	7	12	6	10	11	6	5	3	5	8	6	11	8·5
2		3	6	7	7	4	7	24	7	3	4	15	16	18	14	9	3	3	5	7	10	5	9	8	9	5	4	4	10	5	9	8·0
3		4	4	5	6	2	10	24	6	2	3	14	14	18	15	10	2	2	7	6	6	7	9	10	5	7	4	3	7	3	10	7·5
4		8	5	6	5	1	10	23	8	5	3	15	13	20	17	9	2	2	10	5	8	8	11	10	5	6	6	3	8	6	9	8·2
5		10	4	4	6	2	10	21	7	5	5	18	16	22	15	11	4	4	15	5	9	9	14	10	7	10	6	7	8	3	6	9·1
6		12	3	6	6	3	13	22	9	6	3	13	19	23	16	14	2	4	15	8	12	11	14	13	6	12	7	9	12	5	9	10·1
7		13	3	7	9	7	15	24	11	8	5	17	18	22	17	15	7	5	20	9	14	10	16	12	7	12	5	12	15	6	10	11·7
8		14	2	10	8	10	19	25	16	7	9	22	17	23	15	18	6	8	20	13	13	12	15	13	10	15	7	12	14	7	14	13·1
9		13	3	10	10	10	18	25	17	7	11	18	20	24	12	12	6	5	20	10	15	15	17	12	10	11	10	13	13	7	13	12·9
10		16	3	14	12	6	18	30	22	10	15	18	18	28	13	17	3	7	20	10	13	14	13	14	10	10	10	15	14	11	13	13·9
11		14	3	18	13	4	22	28	24	7	13	21	20	35	11	16	7	8	20	8	1	13	15	9	10	13	12	17	13	10	13	14·3
12		12	3	19	15	11	25	28	27	8	14	24	22	32	14	13	3	10	19	9	15	11	13	10	13	13	11	11	15	12	15	14·8
P.M. 1		13	4	20	13	16	21	30	23	9	14	20	23	31	12	12	13	10	19	7	14	12	12	8	10	11	10	13	16	10	14	14·6
2		13	7	17	13	16	25	29	13	13	17	22	23	29	12	11	11	10	19	8	9	11	12	9	9	13	13	17	16	10	13	14·7
3		13	3	17	14	15	27	27	13	15	15	26	22	28	16	7	16	8	13	8	7	11	13	7	11	8	12	17	18	15	11	14·4
4		15	7	20	20	9	29	26	17	13	14	24	25	22	12	5	7	10	17	4	10	3	12	9	11	8	12	17	14	18	11	14·0
5		15	8	12	17	6	31	20	17	12	8	23	20	20	10	11	6	7	13	8	7	6	13	7	9	7	8	13	10	13	10	12·2
6		12	5	11	15	2	32	19	13	10	7	23	23	25	12	3	9	13	11	3	9	6	11	2	10	4	7	13	8	15	11	11·5
7		13	7	12	9	3	25	18	8	7	8	18	29	21	10	6	5	7	9	10	8	8	11	1	5	1	6	7	8	14	7	10·0
8		9	6	12	7	2	33	15	7	7	5	15	27	20	9	7	3	3	6	5	7	7	8	2	10	1	6	7	3	13	8	9·0
9		4	7	6	10	4	34	12	7	6	10	14	24	19	7	5	2	5	3	7	10	6	10	5	10	2	5	6	3	12	7	8·7
10		7	7	12	12	5	34	11	7	6	13	17	27	17	7	5	1	8	3	7	9	9	12	5	7	5	8	7	4	13	7	9·7
11		2	6	8	5	5	25	12	6	6	10	16	23	18	8	4	1	7	3	4	8	9	9	5	3	4	6	6	2	10	6	7·9
12																																
Total Daily Movement.		240	114	267	247	154	492	544	307	179	217	441	493	556	308	234	127	151	302	170	236	214	288	199	198	185	180	238	248	229	246	11·1

TRANSIT OF THE SHADOW OF TITAN—DOUBLE STARS—THE MOON—OCCULTATIONS.

BY THE REV. T. W. WEBB, F.R.A.S.

TRANSIT OF THE SHADOW OF TITAN.

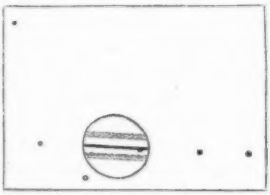
A TOTAL eclipse of the sun to the inhabitants of the earth of course infers the passage of the shadow of the moon over the face of our globe. In consequence, however, of our comparative nearness to the sun, and the resulting breadth of his disc, the cone which this shadow forms tapers so rapidly that its point frequently fails to reach the earth: in annular eclipses it falls short of it; and even in the largest total ones it is but of small dimensions, its section at right angles to the axis seldom attaining a breadth of 180 miles, though it may be greatly drawn out in length if it falls among the shadows cast by the rising or setting sun. The case is very different with the projection of the shadows of the satellites of Jupiter and Saturn. The sun's diameter is so much lessened to them from their greater distance, that the cone of shadow is always prolonged far beyond the surface of the primary, and a dark spot is formed there every time that a solar eclipse takes place; and while the shadow of our satellite upon the earth would be barely visible from the nearest planets with powerful telescopes, and from the remoter ones would be quite imperceptible, the corresponding phenomenon in the system of Jupiter, and, as it now appears, in that of Saturn also as far as the largest satellite is concerned, is sufficiently conspicuous to be witnessed by us with comparative ease.

In the case of Jupiter, these shadow-spots have been familiarly known, since Campani, the celebrated Italian maker of refractors of long focus, first observed one in 1658;* but as regards Saturn, they have been hitherto little noticed. This has been owing in part to the exceeding distance and minuteness of the object; for it is certainly something extraordinary to contemplate the effect of a solar eclipse at a distance never less, often much more, than 760 millions of miles; but it is quite as much due to the different arrangement of that planet's system. The general plane of the orbits of Jupiter's satellites differs so little from that of his own path, that the shadow of three of the satellites invariably, and that of the fourth for the most part, falls on his globe once in every revolution, and every "new moon" there brings a total solar eclipse; but the inclination of the whole system of Saturn to the plane of his orbit is

* *Cycle of Celestial Objects*, I. 171. Arago erroneously gives the discovery to Cassini I. in 1664.

so great, that, excepting about the time when the ring presents its edge to the sun—once in fifteen years—the apparent paths of the more distant satellites are ellipses open enough to carry them and their shadows clear above and below the ball, while the specks cast by the nearer ones would be imperceptibly minute. Consequently, the records of such phenomena are very few, and will naturally relate to the shadow of Titan, the 6th (reckoned outwards) and largest satellite, whose diameter, about three-fourths of a second, according to Struve, considerably surpasses that of the others. Sir W. Herschel was the first to perceive a transit of this shadow, 1789, Nov. 2, and notwithstanding his gigantic instrumental means, he does not appear to have repeated the observation. 1833, May 7, Gruithuisen, who had been watching the ring from March 27 with a 4-inch Frauenhofer achromatic, and had found the knots of light gradually decrease, and at length disappear together with it, says, "I saw, almost in the position where Schröter placed his two knots in the eastern, now not visible, ansa, two satellites, of which the nearest cast its shadow close upon the shadow of the ring, which I at first was inclined to hold as the shadow of a knot in the ring. I saw besides, at a greater distance, the 6th and 7th satellites, to the W. of the former ones." This last expression seems not very intelligible; however, there can be little doubt from his aperture that he mistook the names of these two latter; and as little, that it was Titan whose shadow he saw. 1848, Sept. 20, Schwabe, the great observer of the sun, says that he perceived with the same kind of instrument, upon the very narrow line of the shadow of the ring, between the centre and the W. limb of Saturn, an excessively minute black point; but he does not refer it to the shadow of a satellite; and possibly this, and even Gruithuisen's observation, may have related to one of those curious irregularities in the shadow of the ring which have been remarked by Schröter, Lassell, and De la Rue. If so, Herschel's observation must have stood alone till the present year, for Dawes sought in vain to recover the phenomenon at the last disappearance of the ring in 1848 and 1849. During the present season, however, several persons, led on, as was fitting, by that most clear-sighted and accurate observer, have been more successful. He saw it first, April 15th, with his magnificent 8¼-inch Alvan Clark achromatic. Mr. Lockyer, of Wimbledon, caught the next transit on May 1st. The following one, on May 17th, was witnessed by several observers, and as I was fortunate enough to be one of the number, I have thought that a brief account of its appearance might not be without some interest. I had entirely lost sight of Dawes's announcement of the transit for that evening, and turned my telescope on Saturn, solely with a view of ascertaining whether

any trace of the ansæ might still be perceptible; they had, however, entirely vanished, leaving only a narrow black band, where the ring presented its unenlightened side to the eye. On this band I instantly perceived a spot, which a moment's reflection convinced me must be the shadow of Titan, then preceding at a short distance the N. pole of Saturn; at first I imagined that it projected on each side, like a knot in a black thread; but a little consideration—especially as at the time I had a mistaken impression as to the breadth of the ring—showed that this would give it an exorbitant magnitude, and I speedily satisfied myself, as far as the light of $5\frac{1}{2}$ inches of aperture, and an atmosphere not particularly favourable, would permit, that it stood out only from the N. edge, along which I watched its progress from about $\frac{1}{5}$ to $\frac{1}{7}$ of its path across the ball. Four satellites were unquestionably visible; it was doubtful whether a small object at a short distance *s p*, was Japetus, or a star; probably the latter. Two belts were readily made out. The following diagram will give a general idea of the phenomenon, but it will be borne in mind that it has no pretension to accuracy.



The unexpected size of the shadow on April 15th was noticed by Dawes, and it is very singular that this strange anomaly, detected some time back in the system of Jupiter (see Intellectual Observer, No. III. p. 232), should thus seem to be repeated in that of Saturn. The same observer was highly successful in watching the transit of May 17th, and on the 25th he was probably the first to witness an immersion of Titan into the shadow of Saturn.

The subsequent transits on June 2nd and 18th were invisible from the state of the atmosphere, at least in many places, and I am not aware that any account of them has appeared.

DOUBLE STARS.

The evenings are now beginning to close in, and our time for study is proportionally extending. Wega, the lovely gem of the zenith, must be postponed, from her inconvenient elevation; but we shall use her as a *pointer* to other objects. We will draw a long line from Arcturus, our *pointer* of last month, towards the E., sloping somewhat downwards, and a shorter line from Wega to the S., tending towards the W. These two lines will intersect each other at right angles near a 2nd mag.

star, which though not a brilliant object, takes the first rank in a dull neighbourhood. This is *Al Râi*, alias *Ras-al-hangue*, in the head of the large though inconspicuous constellation *Ophiuchus*, whose legs reach below the serpent which he is carrying, a long way towards the S. horizon. A few degrees W. and slightly N. of this star, is a much smaller one, *Ras-al-Gjâthi*, marking the head of *Hercules*, another widely extended constellation in an unaccountably undignified posture, kneeling on one knee with his feet uppermost. The heads of these two singular figures thus awkwardly "laid together" for thousands of years, ought to be familiar to the student as guides in a neighbourhood barren to the eye, but full of telescopic interest; the head of Hercules itself giving us a grand object;—

24. *α Herculis. Ras-al Gjâthi.* 4″·5. 118°·7. 3½ and 5½. Orange and emerald or bluish-green; *intense cærulea*, according to Struve. Sir W. Herschel considered that the principal star was variable from 3 to 4 mag. in 60¼ days: Struve has not confirmed it, but has seen the companion sometimes 5, at others 7 mag. Argelander, who doubts this, fixes the period of the large star at 66·4 days; Baxendell at 88·5 days. This "lovely object," as Smyth calls it, "one of the finest in the heavens," though looking so much like a system, has not as yet been proved to be in motion. A power of 80 will draw it out and show its colours in a good glass, though of course it will gain in beauty by magnifying.

25. *δ Herculis.* 25″·9. 173°·9 (1830·71). 24″·5. 175°·1 (1839·62). 4 and 8½. Greenish white and grape-red. Struve during 7 years marked the companion "albacinerea." I thought it bluish-green in 1850. Fletcher made them yellow and red, 1851·67; Dembowski, yellow and blue, 1854, 1855; white and blue, 1855, 1856. This is probably a binary system, and if so, is a fair instance of a very remarkable fact, which, however, does not depend upon such slender proof as this single example, but is evident in other cases and ways, that *the brightness of stars is*, at least in many cases, *no indication of their real distance*. Here we have an 8½ mag. star in all probability as near to us as its very much larger companion. This conclusion once admitted—and how it can be resisted, it is difficult to see—very remarkable consequences follow; speculations, however ingenious and beautiful, which assume anything like a general distribution of stars throughout space according to apparent magnitude, fall away of themselves; and but for the modern improvement in instruments, which renders the determination of parallax no longer impossible, we should be left in entire uncertainty as to the real marshalling of the starry host; and even that "longior scala astronomorum," as Kepler calls it, while it confirms the overthrow of all arrangements based

on apparent brightness, is applicable, from the extreme minuteness of the measures required, and their rapid decrease and disappearance with increasing distance, to so few cases, that we still feel bewildered as at the entrance of a mighty labyrinth; so very few are the known points, the unknown, practically infinite.

To find δ, run a line N. from *a*, which will strike it at 10° distance; it will be the first conspicuous star in that direction, and, though not large, the brightest in a considerable region.

26. δ *Serpentis.* 2″·8. 196°·2. 3 and 5. Bright-white and bluish-white; under the very best vision, both bluish. Dembowski gives yellow tints, probably from his telescope. Motion is suspected in this very fine pair, which may be found by drawing a line through the two stars called *Yed* (see No. 15) towards the right, and bending it a little upwards; this will pass, at some distance, through three stars, of the 3rd, 2nd, and 3rd mags. the centre one, which is by far the brightest, is *a Serpentis*; the furthest is our object, δ.

27. κ *Herculis.* 31″·4. 9°·7. 5½ and 7. Pale-yellow and reddish-yellow. Probably stationary. To find it, run a line through the "two heads," *a Ophiuchi* and *a Herculis*, and bend it a little upwards; at a considerable distance it will strike upon β *Herculis*, 3 mag., the brightest star in a wide region; a little *s p* from β lies a smaller star, γ, in the *unbent* line through the "two heads." Another line through β and γ, bent a little upwards, falls upon several minute stars close together, rather further from γ than γ is from β: κ is the most to the W. of these. It is also nearly in a line from γ Herculis to δ Serpentis (No. 26).

28. 53 *Ophiuchi.* 41″·3. 192°·5. 6 and 8. Greyish and pale blue. This beautiful object, which seems only optical, is rather minute for the naked eye in twilight, but it is not difficult to find, as it lies due *s* of *a*, only 3° distant; the space between *a Ophiuchi* and *a Herculis* being about 5½°.

The *number* by which this and other stars are designated, is that assigned by Flamsteed, and denotes the place in his catalogue, in the order, not of brightness, but of Right Ascension.

Before it sinks too far towards the horizon, we had better turn to—

29. 12 *Canum Venaticorum. Cor Caroli.* 19″·8. 227°. 2½ and 6½. Flushed white and pale lilac, 1837·4. There is some doubt about these tints. Herschel II. says, in 1830 or 1831, "with all attention, I could perceive no contrast of colours in the two stars." His father calls them white, inclining to red; Struve, in 1830, made them white; Sestini, in 1844·5, yellow and blue; Smyth, again in 1850·5, full white

and very pale; in 1855, pale reddish-white and lilac; Dembowski, in 1856, white and pale olive-blue. I found them, about 1850·5, with a $3\frac{7}{10}$ inch object-glass, white or a little yellowish and tawny or lilac; 1862·2, with $5\frac{1}{3}$ inches, the same colours, but with very little contrast; $6\frac{1}{3}$ seemed rather orange-tawny, but became bluish when its light was materially reduced by the passage of a thin cloud illuminated by the Moon. These variations are probably due to instrumental and personal differences; but as this may not be the case in some other pairs, an instance like the present deserves to be studied, with a view of deciding between real and apparent changes of colour.

This fine pair has been relatively fixed for 57 years, but has a common proper motion. It is easily pointed out, in the middle of a vacant space below the Great Bear's tail, by a long line from Polaris through Alioth, or ε Ursæ Majoris, the 5th star of that constellation, counting from right to left.

For a reason the reverse of the last, we will take a fine object in *Cassiopea* before it attains an inconvenient altitude. This constellation, "the Lady in her Chair," is generally known from its resemblance to the letter W, the top being towards the Pole; the student will find it about the beginning of August in the evening, bearing N.E., at some distsnce to the right of the Pole Star, but at a somewhat lower elevation.

30. *η Cassiopeæ.* 9″·8. 87°·8 (1830·91). 7″·7. 108°·3 (1854·17). 4 and $7\frac{1}{2}$. Dull white and lilac. Herschel II. and South gave red and green. Sestini, yellow and orange; Struve, *flava* and *purpurea:* so Fletcher. Smyth calls this a "superb physical object," with a period of about 700 years, and a considerable proper motion of nearly 2″ in R.A., and $\frac{1}{2}$″ in Declination annually. Eyre Powell reduces the period to 181 years. We have here a striking instance of the fact referred to under No. 25, *the equal distance from our eye of stars of very different magnitude.* It is readily found by learning the letters of the five conspicuous stars, which, beginning at the right-hand end of the W, and reckoning backwards, are β, α, γ, δ, ε. Our object is nearly in a line between α and γ, nearer to α. Smyth could see it with two inches of aperture.

THE MOON.

The surface of our satellite is at once a very easy and a very interesting object of telescopic research. As not merely the general arrangements of its lighter and darker portions, but even the greater irregularities of its "terminator," or boundary of light and darkness, are visible to the naked eye, it is evident that the smallest telescope will suffice to give us some curious information; while instruments of moderate size,

such as are now becoming both cheap and common, will bring out details enough to occupy, in their close study and careful delineation, the leisure hours of many a long year. This branch of astronomy will be found peculiarly within the reach of the numerous class of amateurs whose telescopes are furnished neither with micrometers nor clockwork motions; and it is one in which they may do good service, provided only the judgment of the eye is good in estimating proportions, and the hand fairly practised in the most desirable acquirement of drawing. This latter is, indeed, an acquirement—accomplishment, in the ordinary sense, seems too trivial a name for it—of more value than the inexperienced may be aware of; for it is found that the habit of representing what is seen reacts upon the mode of seeing, and the accuracy of the hand increases the discrimination of the eye, so that a practised draughtsman distinguishes more, especially in a complex object, than one ignorant of design, even with a naturally keener sight. The micrometer is by no means so necessary in this pursuit as in the observation of double stars, since, however desirable it may be to fix the principal points in a lunar survey by actual measurement, the details may be quite as well filled in by hand; while, should a micrometer be employed, the trouble of arranging an artificial illumination is avoided. Schröter employed, in his numerous delineations, a contrivance called a "projection machine," which consisted merely of a white surface, divided by parallel lines into numerous small squares, placed at a convenient distance from the eye, and exposed to a suitable illumination. His telescope being of the Newtonian construction, this surface was supported by a bar fixed perpendicularly to the tube at its mouth, and thus he was enabled to view at the same time any lunar region with the right eye in the eye-piece, and the divided surface with the left eye, unaided, across the open end of the telescope, so that, by means of a paper similarly divided into squares, he could make drawings with greater accuracy than could be attained by the eye alone, though inferior to that resulting from the use of the micrometer. This method of projecting the image on a divided scale (whence the name of the apparatus) is now found useful for microscopic purposes: it would be difficult to attach it to an achromatic telescope; and if measurement is desired, the object might be more conveniently attained by inserting in the focus of the eye-piece a little divided glass scale, which may be obtained of Messrs. Horne and Thornthwaite, 121, Newgate Street; or the photographic image of a scale, which I had tried by a friend some time ago with a very fair prospect of success, and which has since, I understand, been advertised for sale. However, a practised eye, capable of estimating pretty sharply

multiples or fractions of any assumed distance, as well as *bearings* or angles of position, will leave little to be desired by an amateur in this matter, as our details are relatively fixed, and in subsequent comparisons it is easy to leave a margin for the differences of eyes, or of the same eye at various times, without the risk of mistakes in identification.

The intention of the papers, of which this is the commencement, will be to point out to such of our readers as may feel disposed to take up this interesting pursuit, some of the most remarkable features of the moon, more especially with the hope that those who possess sufficient optical means and leisure may be induced to study them and delineate them with care, and thus assist in accumulating a body of evidence which may, by ultimate comparison, be found to possess much value. Notwithstanding the worthy labours of our predecessors, there is plenty of room here for the diligent co-operation of many eyes and hands. Schröter's exemplary fidelity in observing and recording was not well seconded by his pencil: his designs are coarse and rough, and contain little of the finer details. Russell's lunar globe and maps are beautiful and ingenious, but not accurate enough to possess much value as standards of reference: a globe of the moon *in relief*, by the same observer, may be seen at the South Kensington Museum, but, unlike the marvellous production of Madame Witte described in Herschel's *Outlines*, can only be regarded as a curiosity. Lohrmann's accurate and ugly "sections" comprise, like the views of Schröter, only a portion of the moon. The continuation of his work by Schmidt, the present Director of the Athens Observatory, if completed, seems to be unknown in this country. Beer and Mädler's great map speaks for itself as a noble production of industry and skill, and, especially as illustrated by the corresponding two volumes entitled *Der Mond* [The Moon], makes the nearest approach to a complete Selenography; yet the little attention I have been able to give has convinced me—and my opinion is fully borne out by that of a very diligent observer, Mr. Birt,—that, in some regions, at least, the minuter details are less carefully entered than might have been expected from the general style of the work. The drawings and models of Nasmyth are of very limited extent, and the promised publication of Dr. D'Orsan has not yet appeared. On the whole, we are quite justified in saying, that after all that previous observers have done, there are many desiderata in the state of our lunar knowledge. It is pleasant to be able to add, that the deficiency is, in a great measure, such as may be supplied by amateur observation. Not only are the general outlines satisfactorily settled, but many of the minuter configurations. The details which are wanted are chiefly such as are calculated

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to throw light upon the mode of formation of the surface, upon the existence of continued eruptive action, and upon the presence or absence of atmospheric variations indicated by illusory appearances of change. An attempt will be made, in a future paper, to point out the conditions under which such investigations may be attended with success.

OCCULTATIONS.

These, during the present month, are few. The moon, as viewed from Greenwich, makes a near approach to 39 Ophiuchi, 6 mag. on the 5th, at 9h. 4m.; to δ Arietis, 4½ mag. on the 16th, at 10h. 34m.; A^1 Tauri, 4½ mag. immerges, Aug. 17th, 11h. 26m., and reappears at 12h. 18m., followed by A^2, 6 mag., at 11h. 38m. and 12h. 35m. respectively. These two stars lie a little *s f* from the Pleiades, in the direction of Aldebaran.

PROCEEDINGS OF LEARNED SOCIETIES.

BY W. B. TEGETMEIER.

GEOLOGICAL SOCIETY.—*June* 18.

Raised Beaches of Scotland.—In reference to a paper of Mr. Geikie, an account of which appeared in the Intellectual Observer, vol. I. page 319, Mr. W. Carruthers made a communication in which he stated that in the section of clay, sand, and gravel near Leith, described by Mr. Geikie as part of a raised beach elevated since the period of the Roman occupation, not only have mediæval pottery and tobacco-pipes been found as described by Mr. Geikie, but a mediæval jar has been met with in the sand beneath. The so-called "Roman" pottery was stated by Mr. Carruthers to be of mediæval age, on the independent authority of Messrs. Birch and Franks of the British Museum; and he believes that the beds in question are mainly of late and artificial formation; he does not, however, argue from this that there is no evidence of a late upheaval of the central part of Scotland.

On the Sudden Destruction of Fishes in the Sea.—The formation of deposits containing the remains of fish in vast numbers was illustrated in a very interesting manner by Sir William Denison, Governor of Madras, who, in a letter read before the Society, stated that when steaming between Mangalore and Cananore, on the west coast of India, he found that for some time after the south-west monsoon the sea was offensive with dead fish, killed by the great mass of fresh water poured into the sea during the season of the monsoon.

CHEMICAL SOCIETY.—*June* 26.

ARTIFICIAL PRODUCTION OF ORGANIC COMPOUNDS FROM BOGHEAD NAPHTHA.—At the last meeting of the Chemical Society Mr. Greville Williams, F.R.S., read a paper, in which he stated that he had succeeded in obtaining the iodides of several alcohol radicals from Boghead naphtha. When we consider the almost infinite variety of metamorphoses which these iodides may be made to undergo, it is evident that an almost inexhaustible mine of research has thus been opened. Acids, alcohols, ethers, aldehydes, alkaloids, etc., may now be produced from Boghead naphtha almost to infinity. Mr. Williams has already procured the iodides of amyle, œnanthyle, capryle, and pelargonyle; he has also obtained the new alkaloids œnanthylamine and pelargonamine.

ENTOMOLOGICAL SOCIETY.—*July* 8.

THE red-letter day of every London entomologist is that one on which Mr. Wilson Saunders of Reigate invites the members and a select number of scientific men to meet the President and Council of the Entomological Society. The day is always commenced by an excursion to some neighbouring district; the locality selected this year being Betchworth Park, Deepdene, and Brockham. The day was one of the most brilliant of this uncertain summer, and enabled the visitor to enjoy to the utmost the beauty of the Wealden district, that has been so appropriately named the Garden of England.

It could be wished, but is hardly to be expected, that each of these scientific explorations should be rewarded by the discovery of some new species. Though not so fortunate on this occasion, the members were gratified by the capture of several rare and interesting insects, among which may be mentioned *Myrmidonia Haworthii*, one of the rarest of the Staphylinidæ, also *Calomicrus circumfusus*, which was found in tolerable abundance on the furze, and *Ilobates propinqua*. At Mr. Bennett's, at Brockham, the members had the pleasure of seeing several young emeus, about three months old, reared in this country. These birds may be said to have been successfully acclimatized by Mr. Bennett. The particular species is the Dromius irroratus.

On the return to Reigate, the members assembled at the New Hall—an elegant and convenient building, erected for scientific and literary meetings—and there partook of a sumptuous repast. After dinner, Mr. Saunders made some observations on the exact scientific value of entomological collections, stating that study of the habits and mode of life of an insect was necessary to render collecting of any real value; that collectors were not necessarily entomologists; and that collections, however great, were only the means to, and not the end of, entomological science. He also stated that the in-

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ternal anatomy of insects was almost entirely neglected in this country, and that the field was open to thousands of investigators, each of whom could do good service to the cause of science. Speeches were also made by Mr. Smith and Mr. Dunning, president and secretary of the Society; Dr. Gray, General Sir John Hearsey, who has shown that devotion and service to science, is compatible with the most active discharge of arduous military duties; Dr. Wallace, to whom we are indebted for the living specimens of the birds of paradise, and several other gentlemen.

ASTRONOMICAL SOCIETY.

Mr. T. W. Burr exhibited and described a new eye-piece for telescopes, which had recently been constructed for him by Messrs. Horne and Thornthwaite of Newgate Street. It is an improvement on the form of eye-piece much used in microscopes, and known as the "Kellner," or "Orthoscopic," which consists of a double convex lens for field-glass, and a meniscus for eye-glass. This combination requires no stop, and gives a much larger field than a Huyghenian eye-piece of the same power. The alteration made in the new form, which has been named the "Aplanatic," consists in replacing the meniscus by a plano-convex *achromatic* eye-glass, made up of a double convex crown lens and a plano-concave flint one, similar to one of the pairs of a microscope objective. This preserves the advantage of the large and flat field with better definition and freedom from colour than the "Kellner," and is equally applicable to both microscopes and telescopes.

Mr. Burr stated that he had, during several months past, compared an "aplanatic" eye-piece, giving a power on his telescope of 125, with a Huyghenian of 123, and found that upon the sun and moon the field was one-third larger, taking in nearly, or sometimes quite, the whole disc of those luminaries, while the increased light rendered the eye-piece most valuable in observations of the planets, nebulæ, and double stars.

In the discussion which ensued, Mr. Pritchard remarked that he thought it unwise to depart from the Huyghenian form, which was theoretically and practically perfect, but Mr. Burr replied that the practical difference in definition and colour of the new form was so slight that the increased field and light rendered the experiment worthy of trial, and that all improvement would be stopped if we refused to depart from an established construction. Mr. Carrington also stated that he had found the "Kellner" eye-piece in constant use in Germany, especially on comet seekers, where it was much valued for its large field, and that he thought the proposed modification now shown very likely to be an improvement, as nearly effecting a perfect balancing of chromatic aberration.

ROYAL INSTITUTION.

GAS GLASS FURNACES.—At the last Friday evening meeting of the Members of the Royal Institution, Professor Faraday delivered a lecture, explanatory of the construction and mode of action of Mr. Siemen's gas glass furnaces. In these furnaces the gaseous fuel is produced by the combustion of coal in a limited amount of air; the products of the combustion which takes place at the lower part of the furnace having to pass a layer of unignited coal are decomposed; the carbonic acid is reduced to a state of carbonic oxide by taking up an additional quantity of carbon; various gaseous hydrocarbons are also liberated by the heat acting on the coal, and by the introduction of water into the burning fuel steam is produced, which is decomposed by the heated carbon yielding carbonic oxide and hydrogen. The mixed gaseous fuel thus produced passes off from this furnace; it consists of the nitrogen derived from the air; this constitutes about one third of its bulk, and is a useless ingredient as possessing no calorific power whatever; the remaining two consist of a somewhat varying admixture of hydrogen, carbonic oxide, and gaseous hydrocarbons. This gaseous fuel is allowed to ascend a vertical tube, and may be conveyed to any required distance before it is mingled with air and allowed to burn. Such is the general principle of the action. In the furnaces of Mr. Siemen there are, however, certain contrivances, termed by him regenerators, by the aid of which the heat produced is encouraged in its distribution, so that but little of it escapes being utilized. Hence the economy of fuel is estimated, practically, at one half.

The explanation of the value of this process depends on the calorific or heat-giving power of the substances burnt. One part of carbon, if perfectly oxidized, unites with two and two-thirds of oxygen to form carbonic acid CO_2, and evolves sufficient heat to raise the temperature of 8000 parts of water one degree centigrade. If it burns in a limited supply of oxygen so as to produce carbonic oxide, the CO, the amount of heat evolved, would only raise the temperature of 2473 parts of water one degree; but when this amount of carbonic oxide is allowed to burn in a fresh access of air, it evolves the remaining units of heat (viz. 5607) required to make up the 8000 produced by the perfect combustion of carbon.

The calorific power of the hydrogen is very high—being 34,000 as compared with carbon 8000, and that of the hydrocarbon produced may be taken in round numbers at over 12,000; hence the heating power of the whole mixed gaseous fuel is equal to that of an equal weight of carbon; and as it is capable of being applied so much more advantageously, owing to its gaseous form, its practical value is in reality much greater.

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GLEANINGS FROM THE INTERNATIONAL EXHIBITION.

PRODUCTION OF ALCOHOL AND OTHER ORGANIC SUBSTANCES BY SYNTHESIS.—In an obscure corner of a case in the French department may be found a bottle of alcohol, differing in no respect from that obtained by the usual process of fermentation, except in its mode of origin, it having been formed synthetically. The credit of the exceedingly interesting discovery of the possibility of forming this and analagous compounds, that have so long been regarded as belonging exclusively to organic chemistry, is due to M. Berthelot, who ascertained that when olefiant gas (C_4H_4) is agitated for a long time with many thousand concussions with sulphuric acid (SO_3,HO), that sulphethylic acid is produced as indicated by the following formula :— $C_4H_4 + 2(HO,SO_3) = C_4H_5O,SO_3,HO,SO_3$. When sulphethylic acid is heated with water, alcohol distils over, and sulphuric acid remains behind. In connection with the artificial productions of alcohol, M. Berthelot's researches on the formation of acetylene are very important, as tending still further to break down the distinction between organic and inorganic chemistry. Acetylene is one of the most permanent of the hydrocarbons; its composition is expressed by the formula C_4H_2. It is produced by the action of the induced electric spark, or by the aid of heat from olefiant gas, and is also developed by the action of heat on the hydrocarbons benzole and naphthaline. Berthelot has succeeded in preparing acetylene by the direct union of its elements, carbon and hydrogen. The carbon is first purified by the action of chlorine at a high temperature. This removes sulphur and metallic impurities in the form of volatile chlorides. The carbon thus obtained in a perfectly pure state may be submitted to the action of hydrogen, aided by the highest temperature that it is possible to obtain, but no union will take place. In the like manner the inductive spark is equally powerless to effect their union. If, however, an electric arc is caused to pass between two charcoal poles or electrodes surrounded by an atmosphere of hydrogen, union takes place as soon as the spark commences to pass. Acetylene being produced, and its production continued as long as the electric arc is maintained, the acetylene produced around the poles may be carried away by a current of hydrogen, and condensed by passing through an ammoniacal solution of protochloride of copper. In this manner it is easy to obtain large quantities of acetylene, which is readily liberated in a free state by the action of hydrochloric acid. Acetylene is very important, as it presents a basis from which other bodies may be obtained; thus Berthelot has demonstrated that by the simple addition of hydrogen it can be changed into olefiant gas, and that from olefiant gas alcohol can be formed, from alcohol ether, and thus the commencement be made of a chain of compounds, all of which have been hitherto regarded as belonging exclusively to the domain of organic chemistry.

ANCIENT EGYPTIAN JEWELLERY.—In the gallery of the Turkish court there is a case of ancient Egyptian jewellery, taken from an

Egyptian tomb, the date of 1900 years B.C., the time of the patriarch Abraham. The collection comprises earrings, necklaces, seal rings, and amulets; the workmanship of which is of the most beautiful description. The most interesting object in this case, however, is a model of what was termed the Boat of Death, in which is represented the carrying away of the soul of the departed. A small silver image of the deceased queen is placed in the boat, and the rowers sit on either side. [In cases near this there are beautiful specimens of extremely delicate modern filagree ornaments, both gold and silver, from Nubia. It is interesting to contrast this work with that executed by the same race nearly 4000 years ago.]

Rapid Growth of Vegetables in High Latitudes.—In a valuable treatise on the vegetable productions of Norway, which has been published by Dr. Mueller, in connection with the Norwegian department of the Exhibition, some extraordinary facts are related respecting the influence of the long duration of light, during the summer months, on the growth of vegetables in the higher latitudes in Norway. At seventy degrees N. it was found that ordinary peas grew at the rate of three and a half English inches in twenty-four hours for many days in summer, and that some of the cereals also grew as much as two and a half inches in the same time. Not only is the rapidity of growth affected by the constant presence of light, but those vegetable secretions which owe their existence to the influence of actinic force on the leaves, are also produced in far greater quantity than in more southern climates; hence the colouring matter and pigment cells are found in much greater quantity, and the tint of the coloured parts of vegetables is consequently deeper. The same remark applies to the flavouring and odoriferous matters, so that the fruits of the north of Norway, though not equal in saccharine properties, are far more intense in flavour than those of the south.

Utilization of Waste Tin Plate.—The utilization of waste products is now a subject attracting much attention. Among the more remarkable of these processes we may specially direct notice to that shown by Kuhn, in the Austrian court, by which the tin from the useless scraps of tinned iron plate is obtained in a pure form. It is stated by the discoverer that the labour of four men can produce yearly from perfectly valueless tin cuttings three hundred weight of pure tin, with a large proportion of malleable iron and other products.

Disintegrated Black Lead.—The chemically-disintegrated graphite of Mr. Brodie is a subject of great interest, as it affords a ready means of obtaining a chemically pure black lead, that by mechanical pressure can be aggregated into a solid mass, and employed for those purposes for which the best and most expensive plumbago has hitherto alone been applicable. The outline of the process may be thus stated: the impure plumbago is mingled with chlorate of potash, and then acted upon by a mixture of nitric and sulphuric acids; these not only give rise to the evolution of gaseous chlorine compounds, but also dissolve up and remove many of the impuri-

ties. The plumbago, thus obtained in a pure form, is washed and heated, the result of the combined mechanical and chemical action of these operations is, that the plumbago is so perfectly disintegrated as to be formed into light floculi, which are capable of being blown away by the slightest current of air. In this condition they are readily condensed into solid blocks by pressure.

Phosphorized Copper and Brass.—The peculiar effects of the presence of small portions of phosphorus on the properties of metallic copper have been studied carefully by Mr. Parkes, who has taken out a patent for the application of phosphorus to the improvement of the working properties of metallic copper. Phosphorized copper, as it is termed, possesses an extreme degree of malleability and may be forged readily even when heated to redness; it is so ductile that it is capable of being drawn out into tubes which can be flattened in various directions, or even tied into close knots without showing any evidence of cracking; these tubes are made, in the first instance, by casting them of a large size, and the diameter is then reduced by drawing them in the same manner as wire. The extreme ductility of phosphorized copper is shown by the production of a long tube with a bore as fine as a needle, which has been reduced down by drawing from a nine inch casting. Brass manufactured from phosphorized copper also retains many of its valuable properties.

Insect-destroying Powder.—The exact nature of the preparation so well known as the Persian insecticide powder, has not been generally known. It is produced by the *Pyrethrum roseum caucasicum*, a composite flower growing wild in the Caucasus. The central or tubular florets of the disc are alone employed, and when ground furnish the powder known in commerce. The plant belongs to the same genus as the common feverfew of our hedgerows; several species of Pyrethrum the natives of England and other temperate climates; and it would be interesting to ascertain whether those florets possess the same destructive influence on insect life. Specimens of the plant and its flowers in the various stages of manufacture, are shown in the Austrian and in the Russian courts.

NOTES AND MEMORANDA.

Tobacco Smoking and Angina Pectoris.—In a communication to the French Academy on the 9th of June, M. Beau connects the practice of tobacco-smoking with that very painful and dangerous disorder, angina pectoris. In one case a gentleman of sixty passed the greater part of one day in smoking, and during a month he suffered violent palpitations at night, accompanied by oppression and shooting pains in the shoulders. On leaving off smoking, the symptoms disappeared. Three months afterwards he betook himself again to tobacco, and brought back the complaint, which finally left him when the narcotic weed was definitively abandoned. In the second case a physician about fifty smoked cigarettes all his spare time, his digestion was bad, and he suffered nightly attacks of angina. He gave up smoking, and the disease subsided, but sitting in a room filled with tobacco smoke was enough to cause a return of the pains on the following night. In the third instance a physician of thirty-five smoked as he went his rounds in the country, and for a long time suffered loss of appetite. One

morning, while smoking upon an empty stomach, he was seized with frightful pains in the region of the heart with constriction of the chest. He could neither walk nor speak, his pulse became insensible, his hands cold. The attack lasted half an hour. By M. Beau's advice he left off smoking, promising to let him know if the disorder returned, which does not appear to have been the case. In a fourth instance a young Spaniard continually smoked cigarettes. His appetite vanished and his digestion became difficult. One evening, while smoking, he felt a sudden and violent pain in the chest, as if he had been squeezed in a vice, and his pulse became insensible. The attack lasted ten minutes, and being frightened he consented to forego smoking, and suffered no more. In a fifth case a physician was subject, while a smoker, to constriction of the thorax and neuralgic pains. In a sixth case a merchant suffered similar attacks, but stuck to his cigar, and his disease. In a seventh a hearty man of seventy-five smoked desperately to get rid of his cares, and had three attacks of angina, the last of which killed him. An eighth illustration was afforded by a smoking diplomatist who died suddenly under similar influence. M. Beau observes that M. Bernard produced in various animals a disorder resembling *angina pectoris*, by introducing nicotine into the thorax. He adds, that for tobacco-smoking to produce this disease the practice must be in excess, the individual endowed with a peculiar susceptibility, and likewise suffer from some debilitating circumstance, such as grief, fatigue, or indigestion. Then he considers that the system cannot expel the matter absorbed from the tobacco, and nicotine can accumulate sufficiently to exert a poisonous action on the heart.

The Ova of Entomostraca.—Dr. Baird described in former numbers of the *Annals of Natural History* some new species of entomostraca obtained from mud brought in a dry state from the neighbourhood of Jerusalem, and which he placed in pure water, and allowed to stand during the spring and summer. He obtained six species, and the individuals of two or three species increased rapidly as the weather became warmer. He now adverts to the extraordinary way in which the ova of these creatures can resist continued drought, and mentions his success in rearing specimens from dry mud brought from the neighbourhood of Port Elizabeth, Cape Colony: they afforded several new species.

New Group of Parasitic Crustacea.—Dr. Fritz Müller describes parasites of crabs, to which he gives the name *Rhizocephala* (root-headed). He says: "The head of these apparent worms, which is inserted into the body of the host, emits roots like those of plants—hollow tubes, which, being much ramified, cling round its intestines, and their brood holds a middle place between that of the Lernæ and the Cirrepedes." The parasite of the Porcellana he calls *Lernæodiscus Porcellanæ*, and that of the Hermit Crab, *Sacculina purpurea*. Further details will be found in *Wiegmann's Archiv*, 1862, or *Annals Nat. Hist.* for June.

Nervous System of Polyzoa.—The *Bulletin Universel* (No. liv. p. 179) gives the following account, taken from the *Archiv fur Naturgeschichte* (1860, p. 312), of the "Colonial Nervous System," as Dr. Fritz Müller calls it, of the Polyzoa. "Among those animals which live united in an intimate family or colonial life, such as the bryozoa or polyzoa, we often witness movements either of individuals or of the entire family, and which are evidently voluntary, but resulting less from the volition of individuals than from an impulse of an superior order, appearing to emanate from the entire family. Dr. Fritz Müller, at Desterro, has observed among the Pedicellina, that when individuals have been violently torn away, their peduncles remain adherent to the family, and continue their movements through whole days. In another species he noticed energetic movements of peduncles only bearing individuals in the condition of buds. Considering the relatively high organization of the polyzoa, he was led to believe that, in addition to an individual nervous system, they also possessed a colonial one belonging to the whole family, and presiding over its movements. The discovery in the sea of Santa Catharina of an exceedingly transparent *Serialiaria*, has enabled him to confirm this view. These polyzoa form trichotomously ramified colonies, having the branches laden with individuals. These branches are permeated by a nervous trunk, which swells out at the origin of each branch into a basal ganglion. This nervous trunk is in intimate relation with a nervous plexus which sends branches to a basal ganglion of each individual, and which conse-

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quently establishes a communication between the colonial and the individual nerve systems."

Test for Oxygenized Water.—M. Schönbein finds iodized starch, to which has been added a little acetate of lead, and a little acetic or nitric acid, the most sensitive test for oxygenized water. Peroxide of lead is formed, and this substance evolves the blue colour in the iodized starch, especially in the presence of free acids. Water containing a three millionth part of oxygenized water gives a sensible blue colour with this reagent.—*Archives des Sciences.*

Production of Nitrate of Ammonia by Air and Water.—M. Schönbein has shown that nitrate of ammonia is formed at the expense of air and water, during the slow combination of phosphorus; he has likewise proved that this salt is present in meteoric waters, and has thence concluded that its formation must be due to a very general cause. He now announces that this cause is found in the simple fact of the volatilization of water in free air, and he cites many experiments which confirm this belief. The process which succeeds the best is to cause water to fall drop by drop in a metallic vessel heated above 100° C., without, however, reaching the point at which the liquid passes into the spheroidal state. By holding a cold flask above the vapours which are produced, he condenses enough water to recognize the presence of nitric acid and ammonia. M. Schönbein has remarked that the quantity of nitrate of ammonia condensed with the vapour of the water is very variable, sometimes almost *nil*, and he is disposed, in the absence of any positive determination, to attribute these variations to changes of temperature. It is not, however, necessary that the water should boil, as the salt is produced during all evaporation, and its presence may be shown in the water that remains after a portion has been evaporated. A sheet of filtering paper dipped in pure water, and dried in the air, becomes impregnated with sufficient nitrate of ammonia to be distinguished in the water with which the paper is washed, and it can be discovered in linen that has been washed and hung up to dry. In all these cases the production of nitric acid may be rendered more evident by adding to the water which is evaporated a little potash, to fix the acid. Wet sand dried in the air becomes impregnated with nitrate of ammonia." The editor of the *Archives des Sciences*, from which the above account is taken, regrets that M. Schönbein did not ascertain whether the salt was produced by evaporation of water in a limited quantity of air, as, if so, the objection to the conclusiveness of his investigations, arising from the possible wide diffusion of the salt, and its mere condensation, under the circumstances he mentions, might be removed.

Shell of the Cuttle Fish.—In our third number we called the attention of microscopists to the beautiful character of the shell of the cuttle fish as a polarized object, and we indicated the way in which its structure should be examined. We have since received from Mr. Baker of Holborn an exquisitely prepared slide, containing a thin section of the shell, showing the floors and the corrugated sheets of crystalline carbonate of lime by which they are supported, and separated, so as to make the shell at once firm and light.

New Polariscope Object.—Pleasing results may be obtained with the Platinocyanide of ammonia, a very striking salt, exhibiting the phenomenon of dichroism. It is red in one view, and green in another. With the polariscope the beauty depends on the condition of the crystals. A few experiments will show what is required.

The Comet of 1861.—We learn from *Cosmos* that the astronomers at Pulkova saw this object as late as the 1st of May, after which the nights became too bright to permit their following its course. Towards the end of May, the light in the sky was so strong at midnight that they were able to read in a room facing the north.

Markings on Diatoms.—On this interminable controversy the President of the Hull Microphilosophical Society, George Norman, Esq., remarks that, "after duly considering the cellular or areolar theory, that such structures, though at first view appearing cellular, yet after more careful study and observation, are evidently granular, the granules being in some species isolated and round, in others more closely crowded and compressed, causing an appearance of hexagonal cellulation."